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Mineral profile of mucus and stress-secretion of Snail *B. bengalensis*.

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ABSTRACT

Freshwater edible snail *Bellamya bengalensis* has potential nutritional and medicinal value. snail mucus has been applied in human medical and cosmetics and mucus exhibits various biological activities, such as antimicrobial, antioxidant, anti-tyrosinase, and antitumoral activities. In present work the concentration of total sodium and potassium in mucus of *B. bengalensis* of different shell size (2cm-3.5cm and 1cm-2cm) were analysed. This study was conducted to compare concentration of two sized snail. The investigation results have shown that the concentration of the sodium in mucus and stress-secretion in larger size 9.0±0.17mmol/L and 7.1±0.22mmol/L respectively and in smaller size 8.1±0.22mmol/L and 6.4±0.47mmol/L respectively and concentration of potassium in mucus and stress-secretion in larger size 0.71±0.01 mmol/L and 0.57±0.04 mmol/L respectively and in smaller size 0.60±0.12mmol/L and 0.48±0.07mmol/L respectively. Statistical results were calculated by using student's t-test. In large size group was significantly higher at 0.1% level ($p<0,001$) than small size snail group.

Key Words - *Bellamya bengalensis*, mucus,stress-secretion,sodium,potassium, student's t-test

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INTRODUCTION

Mollusks are an abundant and significant group in the trophic chain of the animal kingdom. The phylum Mollusca is the second-largest animal phylum, with over 100,000 species. The molluscs include many familiar animals, including clams, snails, slugs, and squid, as well as some less familiar animals, like tusk shells and chitons . Mollusks are found in nearly all freshwater and marine environments, and some are found also on land[1]. Among mollusks, gastropods including snails and slugs, represent the most abundant class. Snails in particular are successful animals from an evolutionary point of view, having survived extreme environmental conditions for more than 600 million years, due to their capacity to adapt to different environments and to reach dry land. This indicates that snails have some special adaptive proteins with which they are able to survive in their environment. For centuries snails have been used as a food and as treatment for a variety of medicinal conditions. Freshwater edible snail *Bellamya bengalensis* has potential nutritional and medicinal value.

Mucus and stress-secretion and their potential

Land snails have been used as food and for various medical treatments for centuries (Meyer, 2017). The snail slime (mucus) has many functions in the animal, such as adhesive, emollient, moisturizing, lubricant, and defence. Recently, snail mucus has been applied in human medical and cosmetics. Studies have shown that snail mucus exhibits various biological activities, such as antimicrobial, antioxidant, anti-tyrosinase, and antitumoral activities. In addition, many compounds have been found in snail mucus, such as allantoin, hyaluronic acid, peptides and proteins (Cilia, 2018). Moreover, it has been reported that different kinds of mucus are released from the different types of secretory glands in a snail, depending on the way it is stimulated (Campion, 1961).

Intrigue in the mucus slime trails left by snails and slugs date back to ancient Greece, where they utilized the mucus for its ability to reduce inflammation and the signs of aging (Ekin, 2018). Today snail mucus is still used in skin care products by various companies and is a growing market whose value is expected to approach $770 million by 2025 (Coherent Market Inisghts, 2018).

MATERIAL AND METHODS

Collection of samples

Snail, *Bellamya bengalensis* were purchased from Ranchi market for this part of the study and were kept into separate aquarium for 7-15 days for acclimatization, water was changed on alternate day. They were divided into two groups measuring the shell size, group 1 (2-3.5 cm) and group 2 (1-2 cm).

Extraction of mucus (Lawerence *et al.*,2016) and stress-secretion

Snails were thoroughly cleaned with cleaned napkin to remove all the sand and debris on the shell. The mucus was extracted from the snail by removing the shell with a sterile sharp end metal rod and the mucus aseptically squeezed out from the soft body and collected into a beaker. The stress-secretion was extracted from the snail by giving pressure on near operculum and secretion was collected by syringe, into a beaker. The extracted mucus and stress-secretion were considered 100% concentration and were stored in the refrigerator at 4°C for biochemical analysis. Estimation of Sodium and potassium ion in mucus and stress-secretion by Colorimetric method (Trinder, 1951).

Table 1- Sodium and Potassium (major element) concentration of mucus and stress-secretion in different shell sized (2-3.5 cm) and (1-2cm) of *Bellamya bengalensis.*

Shell Sized Cm	Sodium mmol/L		Potassium mmol/L	
	Mucus	Stress-secretion	Mucus	Stress - secretion
2-3.5	9.0	7.5	0.70	0.60
	9.4	7.0	0.70	0.50
	9.0	7.0	0.73	0.60
	9.0	7.3	0.72	0.55
	9.2	7.5	0.71	0.63
	9.0	7.0	0.70	0.50
	8.9	7.1	0.69	0.63
	9.0	7.0	0.71	0.58
	8.8	6.9	0.71	0.60
	9.2	7.4	0.72	0.60
Mean	**9.0**	**7.1**	**0.71**	**0.57**
S.D	**±0.17**	**±0.22**	**±0.011**	**±0.04**
1-2	8.0	7.0	0.60	0.50
	8.2	6.0	0.60	0.50
	8.5	6.2	0.62	0.60
	8.3	6.0	0.61	0.50
	8.0	7.2	0.60	0.48
	8.2	6.9	0.60	0.50
	8.0	6.0	0.62	0.55
	7.9	6.8	0.60	0.60
	8.2	6.0	0.60	0.60
	8.5	6.4	0.62	0.52
Mean	8.1	6.4	0.60	0.48
S.D	**±0.22**	**±0.47**	**±0.012**	**±0.075**

Table 2- Statistical analysis by student t-test of average concentration (Mean and SD) of Sodium and Potassium in mucus and stress-secretion

Shell sized Cm	**Sodium Concentration mmol/L**			**Potassium Concentration mmol/L**		
	Mucus	Stress-secretion	t-value	Mucus	Stress-secretion	t-value
2-3.5	9.0	7.1	23.0***	0.71	0.57	10.7***
	±0.17	±0.22		±0.011	±0.04	
1-2	8.1	6.4	10.6***	0.60	0.48	5.2***
	±0.22	±0.47		±0.012	±0.075	
Size effect (t-test)	11.2***	1.6		9.16***	5.62***	

*****=P<0.001, Significant at 0.1%**

Table-1 and 2 showed that sodium concentration in mucus in large shell sized (2-3.5cm) snail had more i.e., 9.0±0.17mmol/L than smaller shell sized (1-2cm) snail 8.1±0.22mmol/L, when these values were statistically analyzed, it was observed that large shell sized snail had significantly higher concentration of sodium at 0.1% level. Thus, it can be concluded that sodium concentration is size dependent, bigger the size higher the concentration of sodium. Similarly, table-1 and 2 also showed in case of stress-secretion sodium concentration in large shell sized snail (2-3.5 cm) was more i.e., 7.1±0.22mmol/L than smaller shell sized (1-2cm) snail as 6.4±0.47mmol/L, when these values were statistically analyzed with student t-test, no significant difference was observed ($p>0.05$). Table-2 showed average sodium concentration and standard deviation of snail's mucus and stress-secretion in different shell sized snails. Statistical analysis showed that sodium concentration in mucus was significantly higher than in stress-secretion at 0.1% level. It indicated that sodium concentration in mucus was more than stress-secretion.

Table-1 and 2 showed that mucus in large shell sized (2-3.5cm) snail had more potassium concentration i.e., 0.71±0.011mmol/L than smaller shell sized (1-2cm) snail 0.60±0.012mmol/L when these values were statistically analyzed, it was observed that large shell sized snail had significantly higher concentration of potassium at 0.1% level.

Similarly, table-1 and 2 showed stress-secretion in large shell sized (2-3.5cm) snail had more potassium concentration i.e., 0.57±0.04mmol/L than smaller shell sized (1-2cm) snail i.e., 0.48±0.075mmol/L when these values were statistically analyzed, it was observed that large shell sized snail had significantly higher concentration of potassium at 0.1% level. Table-2 showed average potassium concentration and standard deviation of snail's mucus and stress-secretion in different shell sized snails. Statistical analysis showed that potassium concentration in mucus was significantly higher than in stress-secretion at 0.1% level. It indicated that potassium concentration in mucus was more than stress-secretion.

DISCUSSION

Juan *et al*. (2011) made study on haemolymph plasma constituents of the invasive snail *Pomacea canaliculata* and reported that concentration of sodium in haemolymph plasma of *Pomacea canaliculata* was 59.80±2.21 mmol/L which is more than sodium concentration in mucus and stress - secretion. The concentration of Na^+ in the haemolymph was estimated by South (1990) and Ademolue *et al*. (2011), and reported that Na^+ and Cl^- are the most abundant ions in the haemolymph of slug *Arion ater* and land snail *Archachatina marginata* respectively. Sodium content in horseshoe crab *Limulus polyphemus,* haemolymph was also studied by Stephen *et al*. (2017) and reported that sodium content was 389.5 mEq/L which is significantly higher than present observation in case of mucus and stress-secretion of *Bellamya bengalensis*. It may be due to the environmental factor such as habitat. *Bellamya bengalensis* is freshwater snail and horseshoe crab is marine may be due to this reason in horseshoe crab sodium concentration is high (389.5mEq/L) and in *Bellamya bengalensis* it is 9.0±0.17mmol/L.

Sodium is one of the important body's electrolytes that the body needs in relatively large amounts. Electrolytes carry an electric charge when dissolved in body fluids such as blood. Most of the body's sodium is located in blood and in the fluid around cells. Sodium helps the body keep fluids in a normal balance. Sodium plays a key role in normal nerve and muscle function. The body obtains sodium through food and drink and loses it primarily in sweat and urines. Healthy kidney maintains a consistent level of sodium in the body by adjusting the amount executed in the urine. When sodium consumption and loss are not in balance, the total amount of sodium in the body is affected. The concentration of sodium in the blood may be too low (hyponatremia) & too high (hypernatremia) (James, 2018).

Juan *et al*. (2011) made study on haemolymph plasma constituents of the invasive snail *Pomacea canaliculata* and reported that concentration of potassium content in haemolymph plasma of

Pomacea canaliculata was 0.74±0.06 mmol/L which is in agreement in case of *B.bengalensis* to the present observation i.e. 0.71±0.011mmol/L, may be due to their freshwater habitat. Stephen *et al*. (2017) studied the biochemical profiles of the haemolymph of the horseshoe crab *Limulus polyphemus* and reported that concentration of potassium in haemolymph of the horseshoe crab was 12.5mEq/L which is quite higher than present investigation of potassium concentration in mucus and stress-secretion of snail *Bellamya bengalensis*. Mortem'y (1998) made study on Zebra mussel *Dreissemia polymorpha* during stress and reported that potassium concentration was 0.89±0.12mmol/L and 13.1±0.7mmol/kg in haemolymph and body respectively.

Potassium is classified as an electrolyte because it is highly reactive in water, when dissolved in water it produces positively charged ions. The special property allows it to conduct electricity, which is important for many processes throughout the body. Interestingly, a potassium-rich diet is linked to many powerful health benefits. It may help reduce blood pressure and water retention, protect against stroke and help to prevent osteoporosis and kidney stones. Potassium is the third most abundant mineral in the body and it helps the body regulate fluid, send nerve signals and regulate muscle contractions.

CONCLUSION

Based on the obtained results, it is clear that larger size snail has rich in sodium and potassium than smaller size snail and it is beneficial for human being.

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