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Impact of Coal Pollution on Liver Enzyme (Alanine Transaminase) of *Channa striata* (Bloch) of Godavari Khani (Telangana), India

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Abstract: Godavari khani in Telangana is located on the banks of river Godavari and has large coal deposits. Coal mining in this area has greatly impacted the surrounding environment. Flora, fauna, quality of air and also the waters in and around have been drastically affected by the coal dust and coal ash emanating from the coal mines. Quite a number of respiratory disorders, skin diseases and also sometimes, cancer are linked to coal pollution. Though the impact of coal pollution has been reported, in leading local dailies, not many systematic studies have been conducted to learn about the coal pollution on physiology of aquatic animals. *Channa striata* is the common fish found in the waters, of Godavari khani and this fish was selected for the present study. As liver is the major detoxifying organ of the body, its vital enzymes, are drastically affected under the influence of toxicants and pollutants. In the present study, major liver enzyme such as Alanine transaminase, one of the biomarker for liver damage was selected. The enzyme levels in the serum were estimated under the influence of varying concentrations of coal dust and coals ash (0.5%, 1% and 2%). The enzyme showed significant ($P<0.01$) upsurge under the influence of coal dust and coal ash as compared to the control fish. However, the impact of coal dust was greater when compared to that of coal ash. Our results clearly demonstrated that coal pollution drastically affects the liver enzyme, Alanine transaminase, probably due to destruction of hepatocytes.

Keywords: Alanine transaminase, *Channa striata*, Coal pollution, Godavari khani, Hepatocytes

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Introduction

Godavar ikhani (a collection of mines), located in the Ramagundam mandal and in the district of Karimnagar in the state of Telangana, is well known as coal city. The present study has been based in this location, as the coal mining has a drastic influence on the environment. As the country started become more industrialized, the demand for coal has risen, and to meet this demand, excavation of coal has been commercialized. About 55% of India 's energy are fulfilled by coal energy (Ministry of Mines, 2013). Coal is known as the black gold, as it produces greater revenues. However on the flip side, it has caused severe environmental pollution (Altman *et. al*, 1998; Guha, 2014; CSE, 2018). Heavy mining activity in and around these mines, has lead to heavy pollution due to coal dust and coal ash. Apart from coal pollution, in this area, Radon

pollution in the air of coal mines of Godavari khani has been reported by Rao *et al.* (2001). The coal dust and coal ash emanating from the mines, have shown a deep impact upon the plant and animal life in and around this place. Siboni, *et al.* (2004) have suggested that the heavy metals which are found in the coal could be quite lethal and toxic to majority of the marine organisms. Hillaby (1981) suggested that the increase in coal dust particles, over the gills, up to concentration of about 50 % of the body weight, can cause a reduction in the area of the gills, causing breathing difficulties leading to mortality of fish. These studies clearly suggest that coal particles either as coal dust or coal ash, have a profound effect upon animal and plant life. There are quite a number of reports highlighting the coal pollution of this locality in many of the local dailies, but not many scientific studies have been undertaken. Though coal is known to cause pollution, but specific physiological damage caused by coal on fauna of this area, has not been studied. Therefore, the present study was intended to examine the coal dust and coal ash effect on the fish, *Channa striata,* commonly called as snake headed fish, which is frequently available in the local waters of Godavari khani. To study the physiology of the fish under coal stress, it was appropriate to study the liver enzymes, as liver plays an important role in all the metabolic activities and in detoxification of xenobiotics (Arjun *et al.,* 2022). It was intended to study the liver enzyme, Alanine transaminase under the influence of coal dust and coal ash.

Materials and Methods

Channa striata (30±4 cm), the common murrel was obtained from local waters of Godavari river. After the catch, the fish were carefully transported to the laboratory and transferred to two large plastic tubs. They were acclimatized to laboratory conditions for 48 h before experimentation. The fish were fed *ad libitum* with commercially available fish feed (tubifex blocks) obtained from local aquarium. After acclimatization, fish were separated into different groups (I to VII) and treated for a period of 7 days with different concentrations of aqueous coal ash and coal dust (which were prepared from locally collected coal dust and coal ash) as follow:

Group I: Control Fish
Group II : 0.5% Coal Dust
Group III : 1% Coal Dust
Group IV : 2% Coal Dust
Group V : 0.5% Coal Ash
Group VI : 1% Coal Ash
Group VII : 2% Coal Ash

After treatment the fish were carefully taken out of the water and dissected to expose the heart. The blood was drawn directly from the heart using the syringe. The blood was immediately transferred in to the vials and serum was separated for analysis. Serum alanine transaminase was analyzed by the kit following the protocol provided by the manufacturer.

Each data represents mean ± SE of four determinations. ANOVA was performed and significance level was set at $P<0.01$.

Results and Discussion

There was an overall upsurge seen in the levels of alanine transaminase enzyme in both the coal dust and coal ash treated samples when compared to that of the control samples. Coal pollution, either as coal dust or coal ash has greatly impacted the liver enzyme Alanine transaminase. The present study indicated that among the two pollutants, coal dust seems to have greatly impacted the liver of *Channa striata* as there has been a greater increase in the enzyme levels (Table 1; Figs. 1, 2).

In the present study, coal dust and coal ash caused an increased level of alanine transaminase in the fish *Channa striata*. Liver accumulates maximum concentration of metals in comparison to other tissues (Kalpana *et al*., 2019). Liver is the most sensitive organ which is affected by pollutants, such as carbon, coal etc. Major liver enzymes, such as alkaline phosphatase (ALP), alanine transaminase (ALT) and aspartate transaminase (AST) seem to be affected (Dey *et al.*, 2015). These enzymes are involved in

Table 1: Alanine transaminase levels of *Channa striata* treated with coal dust or coal ash

Group/Parameter	Alanine transaminase (IU/L)	
	Mean	SE (±)
Group I (Control)	33	0.423
Group II (0.5% Coal Dust)	39.9	0.602
Group III (1% Coal Dust)	69.1	1.15
Group IV (2% Coal Dust)	298	1.961
Group V (0.5% Coal Ash)	60.6	0.451
Group VI (1% Coal Ash)	85.5	0.322
Group VII (2% Coal Ash)	90.0	0.658

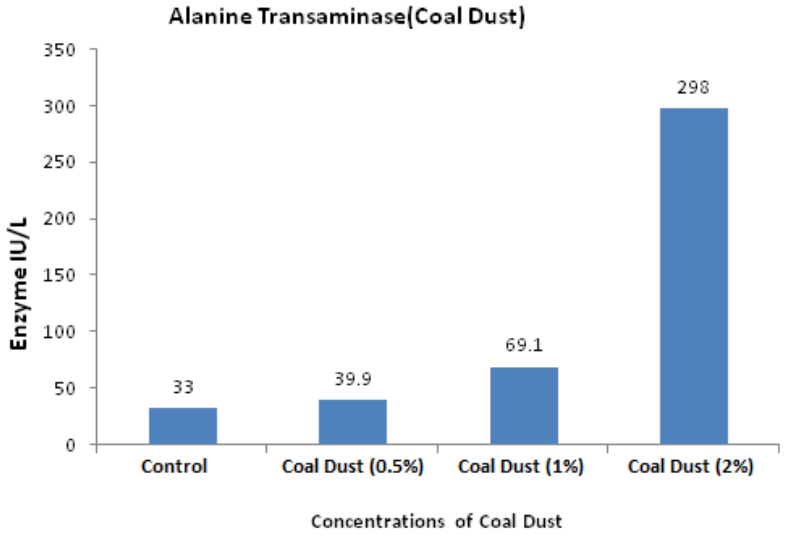

Fig. 1: Serum alanine transaminase levels of *Channa striata* after treatment with coal dust.

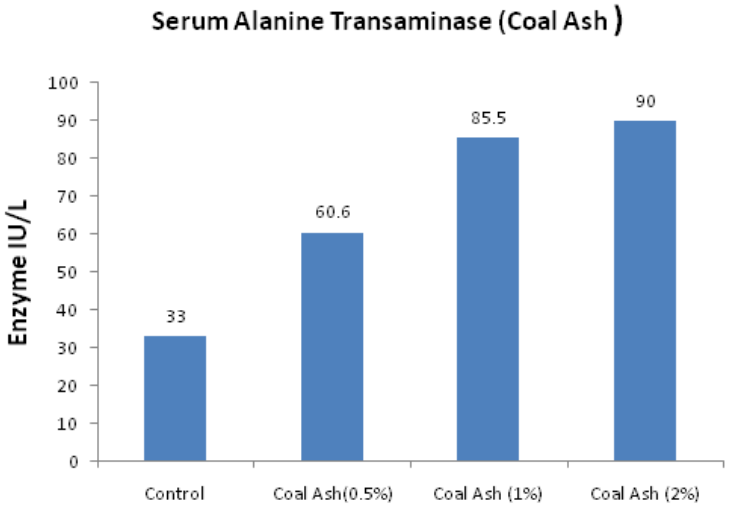

Fig. 2: Serum alanine transaminase levels of *Channa striata* after treatment with coal ash.

physiological processes which will metabolize xenobiotics and their presence in serum illustrates hepatocyte damage as suggested by Huculeci *et al.* (2008), Firat *et al.* (2011) and Banaee (2013). Alanine transaminase (ALT) is an important enzyme found primarily in the liver and plays an important role in the metabolism of food and converting it into energy. It catalyzes the alanine cycle. It is used as biomarker for liver diseases. Alanine transaminase (ALT) is involved in gluconeogenesis and amino acid metabolism. A mild increase in the level of this enzyme in the serum reflects that there may be damage in the hepatocytes, however, if there is a drastic increase in the level of this enzyme it clearly suggests that there is an irreversible damage to the liver cells (Lu *et al.*, 2003; Stockham and Scott, 2008). In the present study, we have observed a drastic increase in this enzyme in the serum under the influence of the coal ash and coal dust. This increase may be due to the destruction of the hepatocytes which is due to the exposure of the fish to different concentrations of coal ash and coal dust. It is concluded that the coal pollution either as coal dust or coal ash, drastically impacts the hepatocytes leading to liver damage.

References

Arjun K, Ekrem Y, Chase JW and Faiz T. (2022) Stat Pearls. https://www.statpearls.com/ArticleLibrary/viewarticle/24376.

Altmann, P, Cunningham J, Dhanesha U, Ballard M and Thompson JM. (1998) Disturbance of cerebral function in people exposed to drinking water contaminated with aluminium sulphate: retrospective study of the Camelford water incident. Brit Med J. 319: 807-811.

Bruslé J Anadon GG. (1996) The structure and function of fish liver. In: Fish Morphology, (eds.) Munshi J.S.D. and Dutta H.M., North Holland, Science Publishers, pp. 77-93.

Banaee M. (2013) Physiological dysfunction in fish after insecticides exposure. Insecticides. doi: 10.5772/54742.

CSE. (2008) Meghalaya Governor releases CSE's study on mining, people and environment. https://www.cseindia.org/meghalaya-governor-releases-cses-study-on-mining-people-and-environment--395.

Dey T, Kabita G, Unni Balagopalan, Moonmee B, Munmi K, Dibyajyoti O, Manoj K, Jatin K, Pranab KB and Thaneswar B. (2015) Role of environmental pollutants in liver physiology: Special references to peoples living in the oil drilling sites of assam. PLoS One 10(4): e0123370.

Fırat O, Cogun HY, Yüzereroğlu TA, Gök G, Fırat O, Kargin F, Kötemen Y. (2011) A comparative study on the effects of a pesticide (cypermethrin) and two metals (copper, lead) to serum biochemistry of Nile tilapia, *Oreochromis niloticus.* Fish Physiol. Biochem. 37 657-666.

Guha D. (2014) A case study on the effects of coal mining in the environment particularly in relation to soil, water and air causing a socio-economic hazard in Asansol Raniganj area, India. Int Res J Soc Sci. 3: 39-42.

Hillaby BA. (1981) The effects of coal dust on ventilation and oxygen consumption in the dungeness crab, *Cancer magister.* Canadian Tech Rep Fisheries Aquatic Sci. No. 1033.

Huculeci DD, Staicu AC, Munteanu MC, Costache M and Dinischiotu A. (2008) Malathion-induced alteration of the antioxidant defence system in kidney, gill, and intestine of *Carassius auratus gibelio.* Environ Toxicol. 24(6): 523–530.

Kalpana CL, Lal Bechan and Banerjee TK. (2019) Coal mine effluent-led bioaccumulation of heavy metals and histopathological changes in some tissues of the catfish *Clarias batrachus.* Environ Monitor Assess. 191: 136.

Lu Q, Li Y, Wen L, Guo S, Chen Y, Liu W, Gao Y and Ding L. (2003) Safety evaluation of recombinant staphylokinase in rhesus monkeys. Toxicol Pathol. 31(1): 14-21.

Ministry of Mines (2013) Government of India. National Mineral Scenariohttp://mines.nic.in/writereaddata/UploadFile/National_Mineral_Scenario.pdf.

Rao KV, Reddy BL, Reddy PY, Ramchander RB and Reddy KR. (2001) Airborne radon and its progeny levels in the coal mines of Godavarikhani, Andhra Pradesh, India. J Radiol Prot. 21(3): 259-268.

Siboni N, Fine M, Bresler V and Loya Y. (2004) Coastal coal pollution increases Cd concentrations in the predatory gastropod *Hexaplex trunculus* and is detrimental to its health. Mar Poll Bull. 49: 111-118.

Stockham SL and Scott MA. (2008) Enzymes. In: Fundamentals of veterinary clinical pathology (eds.) Stockham Sl and Scot T M, 2nd edition, Iowa, Blackwell Publishing Limited, pp. 639-674.