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Role of HSPs in ameliorating deleterious effect of thermal stress in animals

Mehtab Singh Parmar
Department of Veterinary Physiology & Biochemistry, College of Veterinary & Animal Sciences, India

Stress is a complex phenomenon which alters normal physiological equilibrium or homeostasis of animals. It is revealed by inability of animal to cope with its environment, a phenomenon that is often reflected in the failure to achieve genetic potential for production traits. Cells increase the expression of several classes of proteins in response to environmental stresses such as heat shock. Heat shock proteins (HSP) are a class of functionally related proteins involved in the folding and unfolding of other proteins. Heat shock proteins are present in cells under normal conditions but their expression is increased when cells are exposed to elevated temperatures or other stress. Heat shock proteins family consists of many proteins which are classified as HSP110, HSP100, HSP90, HSP70, HSP60, HSP40, HSP10 and small HSP families. The principal heat-shock proteins that have chaperone activity belong to five conserved classes: HSP33, HSP60, HSP70, HSP90, HSP100 and the small heat-shock proteins. Some members of the HSP family are expressed at low to moderate levels in all organisms because of their essential role in protein maintenance. These account for 1-2% of total protein in unstressed cells which increased to 4-6% of cellular proteins when cells are exposed to heat stress. HSPs help in maintaining cellular homeostasis by three principal biochemical activities.- 1) Chaperonin activity 2) Regulation of cellular redox state 3) Regulation of protein turnover and they participate in numerous functions including folding of newly synthesized proteins, transport of protein into cell compartment, disaggregation of protein complexes and other functions.

mehtab.parmar@gmail.com

Mi-64: a high molecular weight glycoprotein from Mastobrancusindicus (marine polychaete) demonstrated antitumor effects in in vitro and in vivo models

Mohammed Aftab Alam
Department Microbiology, University of Calcutta, India

Marine polychaetes have been indicated for the treatment of several diseases including cancer by medicinal men in eastern part of India. The aim of this study was to explore the antitumor effects of Mi-64. Mi-64, a glycoprotein isolated and purified from Mastobrancusindicus (marine polychaete) whole body extract through DEAE-cellulose ion exchange chromatography and high performance liquid chromatography. The molecular weight of the Mi-64 was found to be 130kDa (Alam et al., 2012). MTT assay was performed to determine the antitumor effects of Mi-64 on U937 and K562 cell lines. IC_{50}value were 1.42±0.16 and 2.01±0.35 $\mu g.ml^{-1}$ respectively. Morphometry and bax/bcl-2 ratio studies indicated apoptosis induction in Mi-64 treated leukemic cells. Male Swiss albino mice were treated with Mi-64 (0.25 and 0.5 $mg.kg^{-1}.day^{-1}$) 24h later the Ehrlich ascites/solid tumor implantation.Mi-64 significantly decreased the number of viable Ehrlich ascites carcinoma (EAC), thereby increased the lifespan of EAC bearing mice. Microscopic (Fluorescence and confocal) study on Mi-64 treated EAC cells reveals certain features of apoptosis. DNA fragmentation was clearly observed in alkaline comet assay and agarose gel electrophoresis. Apoptosis induced by Mi-64 was further confirmed through flow-cytometric analysis of annexin-V/PI binding study.Sub-$G_0/_1$arrests in the cell cycle are found to be mediated through caspase 3 dependent pathways. Mi-64 treatment reduced the weight and volume of Ehrlich solid tumor, antagonized the pro-oxidant effect and balanced the pro- and anti-inflammatory cytokines. Histopathological studies also support the ameliorating effect of Mi-64.In conclusion, Mi-64demonstrated caspase dependent apoptosis in Ehrlich ascites/solid carcinoma.

Biography

Mohammed Aftab Alam has completed his Ph.D (2011) from the Department of Marine Science, University of Calcutta and published more than 15 papers in journals of repute. Currently, he is working as a Postdoctoral Fellow in the Department of Microbiology (CU) on platelet activation mechanisms and cancer biology. He is also serving as a Project Consultant in the Department of Marine Science (CU). He has worked on different in vivo and in vitro models of cancer, inflammation, osteoporosis, arthritis, atherosclerosis, toxicity, etc. Research interests are in marine toxins, drugs from sea, cancer and apoptosis, arthritis and autoimmune diseases, cardiovascular diseases and platelet research.

alam.mohammedaftab@gmail.com