Conclusion

Diabetes mellitus, a chronic metabolic disorder and its long-term complications have devastating consequences like cognitive dysfunctions, neurophysiological and structural changes in the CNS. Nutritional therapy is a challenging but necessary dimension in the management of diabetes and neurodegenerative changes associated with it. Behavioural studies showed deficit in spatial learning, memory and motor control in diabetic rats. Our results showed that cholinergic and dopaminergic functional regulations were impaired in diabetes contributing to the neurological dysfunction which is suggested to cause behavioural deficits. Functional role of Vitamin D receptor in diabetes showed changes in brain regions and pancreas thereby contributing to behavioural and cognitive deficit, impaired insulin synthesis and release from pancreas. In diabetes, brain insulin receptor and glucose transporter GLUT3 expression showed alterations which are functionally related to cognitive deficit. Altered pancreatic insulin receptor and GLUT2 expression resulted in decreased insulin synthesis and release. Down regulation of phospholipase C, a second messenger enzyme in the brain regions of diabetic rats showed a defective signal transduction at second messenger level. Decreased CREB mRNA expression induced by diabetes showed impaired long term memory processing. Differential expression of anti oxidant enzyme, superoxide dismutase in diabetes imparts increased oxidative stress. Treatment of diabetic rats with insulin, curcumin and Vitamin D$_3$ reversed the altered cholinergic and dopaminergic neurotransmission, insulin, Vitamin D receptor, GLUT3/GLUT2, phospholipase C, CREB and superoxide dismutase expression in brain and pancreas. Thus our results showed that curcumin and Vitamin D$_3$ have neuroprotective role in diabetes by increasing insulin synthesis and release from pancreas, maintaining glucose homeostasis, which in turn lead to a novel therapeutic management of diabetes.