Summary and Conclusions
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Diabetes is a primary disorder characterized by hyperglycemia resulting in microvascular and macrovascular damage. The disease is prevalent all over the world and has been a serious threat to mankind for centuries. The associated complications, significant morbidity rate, reduced life expectancy and diminished quality of life has urged for new molecule or drug with affordable price for effective treatment of diabetes as well as safer for long term usage. Regular exercises, diet and synthetic drugs are possible ways of managing diabetes. However, these drugs are expensive and are known to cause many side effects, further total recovery from diabetes has not been reported upto this date. Therefore, discovery of efficient anti-diabetic agents, especially made from natural sources is an on-going research globally.

Herbal hypoglycemic agents are the major area of interest to provide better alternative option and to avoid harmful side effects caused by prolong intake of synthetic drugs. The present study illustrates the role of *Rotula aquatica* as an effective therapeutic source in complication associated with diabetes, viz., antimicrobial properties, antioxidant properties and antihyperglycemic activities by stimulating insulin secretion from β-cells of the Islets of Langerhans and enhancing glucose utilization by acting like insulin under *in vitro* and *in vivo* models.

The urge for replacement of chemical antibiotics due to emergence of multi-drug resistant strains has provoked for utility of safer herbal medicine. In this regard, the inhibitory spectrum of methanolic extract against tested pathogens indicates the great potential of *R. aquatica* in treating infectious diseases. The present study confirms that extract of *R. aquatica* have significant antibacterial and antifungal activity along with valuable phytochemicals. These results recommend the application of *R. aquatica* component extracts in human protection against the test pathogenic bacteria.
Antioxidants compounds have been identified as major health beneficial compounds that protect the body against free radical mediated toxicities and also reduce oxidative stress. The present study shows a significant antioxidant activity of methanolic extract of *R. aquatica*. The obtained results suggest the positive correlation of phenolic content in *R. aquatica* for its antioxidative potential. The present study demonstrates that the methanolic extract of *R. aquatica* can neutralize free radicals, thus protecting from oxidative stress. Thus signifying its importance in food and nutraceutical industries.

*In-vitro* analysis revealed that the methanolic extract of *R. aquatic* has significant inhibitory activity on pancreatic α-amylase and α-glucosidase activity which offers an attractive therapeutic approach for the treatment of postprandial hyperglycemia by decreasing the release of glucose.

The preclinical studies using diabetic induced rats showed the non-toxicity nature of methanolic extract of *Rotula aquatic* and its remarkable effect on blood glucose level. Marked improvement in lipid profile of diabetic rats was observed on treatment with plant extract. Improvement in superoxide dismutase, catalase and lipid peroxidase justifies the protective ability of extract against oxidative stress. After 21 days of treatment a significant reduction (24.8%) in blood glucose level was observed indicating the hypoglycemic effect of *R. aquatic*. Histopathological studies of vital organs revealed the noticeable improvement in tested organs.

Since rational use of allopathic drugs leads to adverse drug reactions and the patients have to undergo long term treatment and the same is not affordable by the weaker sections of the society. Herbal drugs are cost feasible and have host friendly approach compared to the synthetic drugs. They may even become the base for the development of a medicine, a natural blue print for the development of new drug to monitor the various complications associated with Diabetes.