# EVALUATION OF ANTI-DIABETIC PROPERTIES OF THE COMPOUNDS ISOLATED FROM MARINE MACROALGAE


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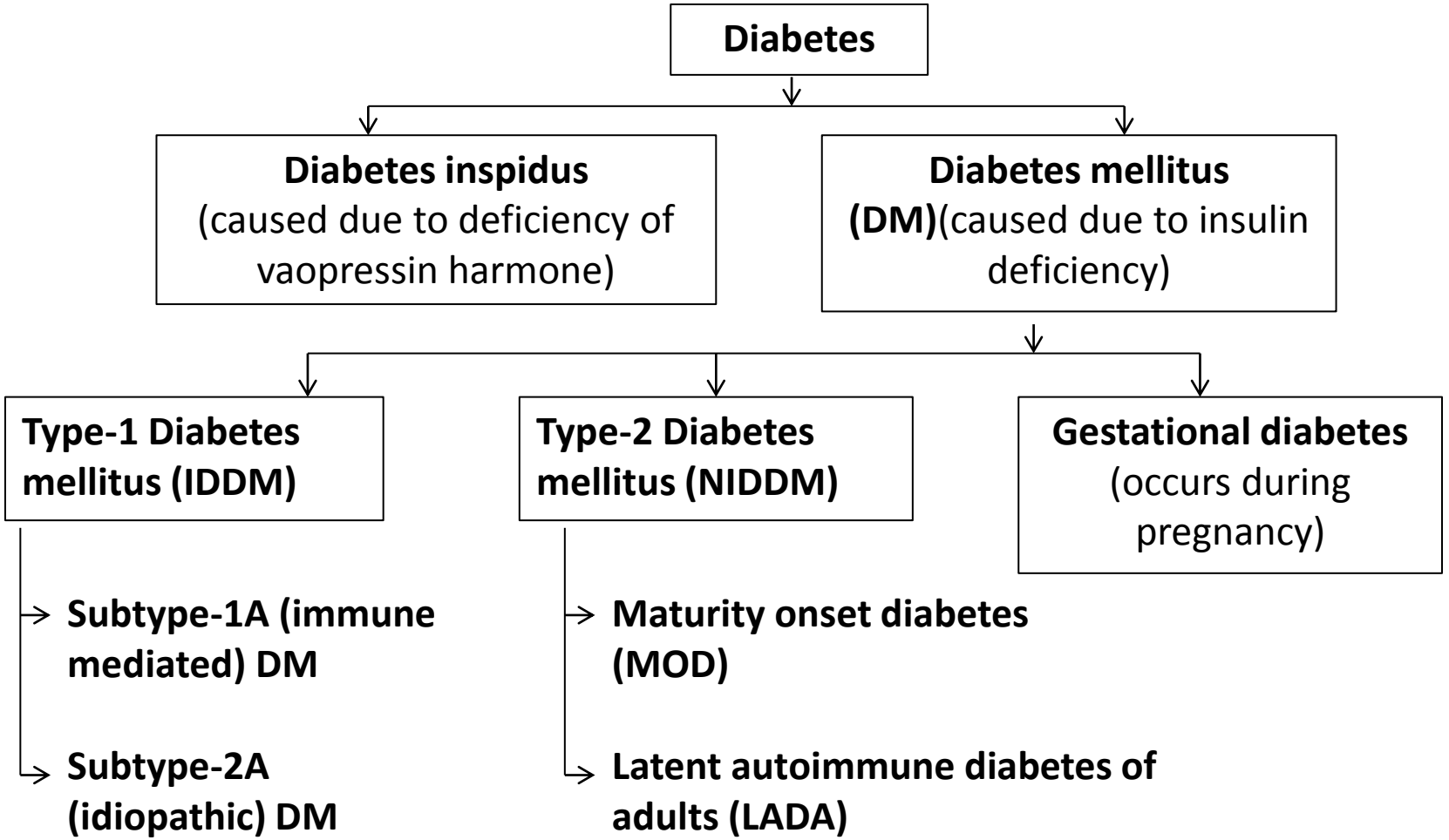
# INTRODUCTION

- Diabetes is a disorder of metabolic causing excessive thirst and production of large urine



# DIABETES MELLITUS

- Diabetes mellitus is a chronic metabolic disorder to the man kind related to:
  - Abnormal insulin production, or
  - Impaired insulin utilization, or
  - Both of the above

- Leading cause of heart disease, stroke, adult blindness, and non-traumatic lower limb amputations

- Above 360 million people world wide, 66.3 million people in India were suffering with DM because of over nutrition and sedentary life style. (Himanshu et al., 2014; Nandakesav et al., 2015).

- Even though there was tremendous development in modern medicine, management of diabetes without any side effects is still challenge to medical systems.

- WHO expert committee recommended the traditional medicine and their activity in bringing control on uncontrolled glycemic and other disorders implicated in the diabetes.

# MARINE MACROALGAE

- Marine macroalgae have been used as drug source in folk medicine.
- They are the producers of the oceans that have the unique ability to with stand salt- triggered oxidative stress conditions, without any oxidative damage in their structural components.
- It was reported that the Polysaccharides, glycolipids, small molecular weight bioactives, and phenolic components in these marine flora were found to competitively inhibit metabolic activities in an oxidative stress induced diabetic reactions, resulting in increased production of insulin.
- Marine macroalgae compounds were obtained from Dr. Kajal Chakraborty labs, Central Marine Fisheries Research Institute, Cochin, Kerala, India.

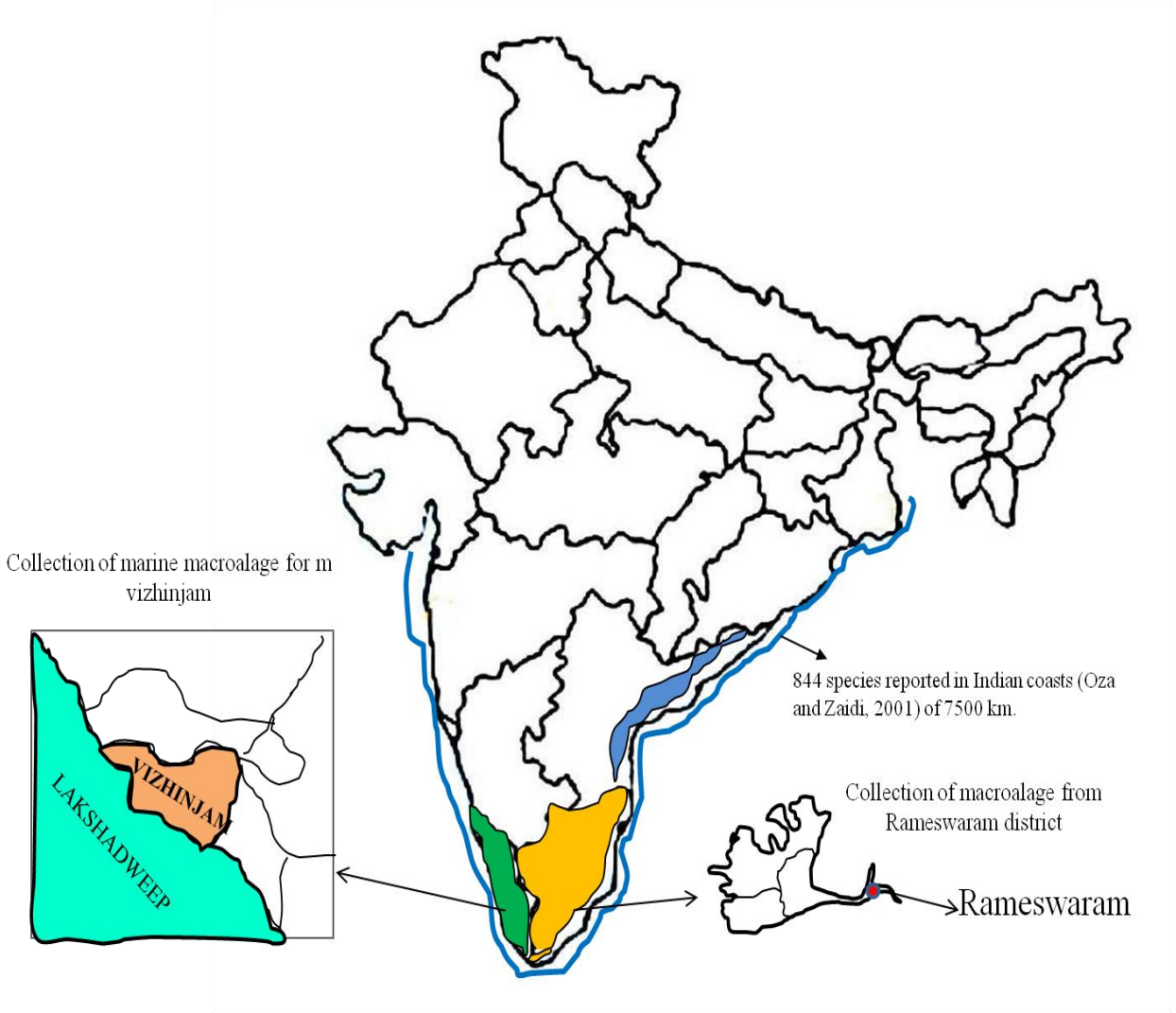
# OBJECTIVES

To evaluate and screen various extracts of marine macroalgae for natural bioactive compounds for stress induced Diabetes mellitus with following objectives.

- To collect and screen various bioactive extracts obtained from marine macroalgae on STZ induced diabetic rats.
- To evaluate the anti-diabetic activity of the various bioactive extracts from marine macro algae.
- To determine the effect of marine macroalgae bioactive extracts on anti-oxidant modulations during STZ-induced diabetes.

# MATERIALS AND METHODS

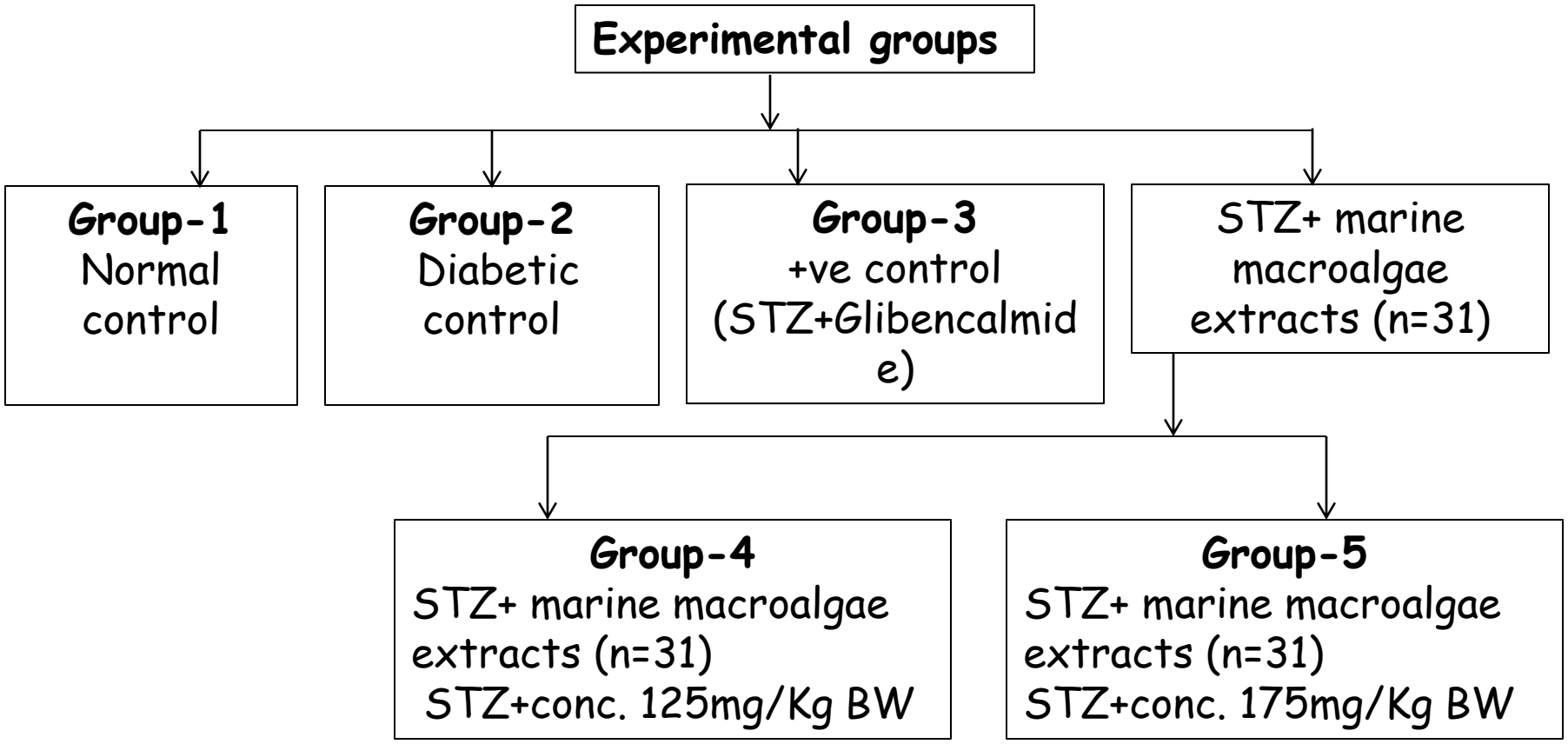
- Collection of marine macroalgae samples:



## ➢Solvent (methanol, ethanol) and aqueous extracts of red and brown seaweeds

| Sample code | Genus name | Sample code | Genus name |
|---|---|---|---|
| **Red seaweeds** | | **Brown seaweeds** | |
| **Aqueous extracts** | | | |
| FS4 | *Gracillaria opuntia* | PS1 | *Turbinaria conoides* |
| FS1 | *Kappaphycus alverizii* | A1 | *Sargassam weightii* |
| EM2 | *Laurentia pailosa* | A2 | *Sargassam myriocystum* |
| EM3 | *Jania rubens* | G1 | *Padina gymnospora* |
| FM1 | *Kappaphycus alverizii* | EM9 | *Padina tetrastomatica* |
| FM4 | *Gracillaria opuntia* | S3 | *Turbinaria ornate* |
| **Methanolic extracts (MeOH)** | | | |
| F1 | *Gracillaria opuntia* | SF1 | *Turbinaria conoides* |
| K1 | *Kappaphycus alverizii* | PH1 | *Sargassam weightii* |
| MV1 | *Laurentia pailosa* | S2 | *Sargassam myriocystum* |
| MP1 | *Jania rubens* | F1 | *Padina gymnospora* |
| FS2 | *Hypnea musciformis* | S1 | *Padina tetrastomatica* |
| EM1 | *Hypnea valentiae* | S4 | *Turbinaria ornate* |
| **Ethanolic extracts (MeOH)** | | | |
| FM2 | *Gracillaria opuntia* | S7 | *Sargassum weightii* |
| FM3 | *Kappaphycus alverizii* | AE3 | *Turbunaria conoides* |
| FS5 | *Laurentia pailosa* | SF | *Sargassum myriocystum* |
| | | S1 | *Turbinaria ornate* |

➢ Experimental design:



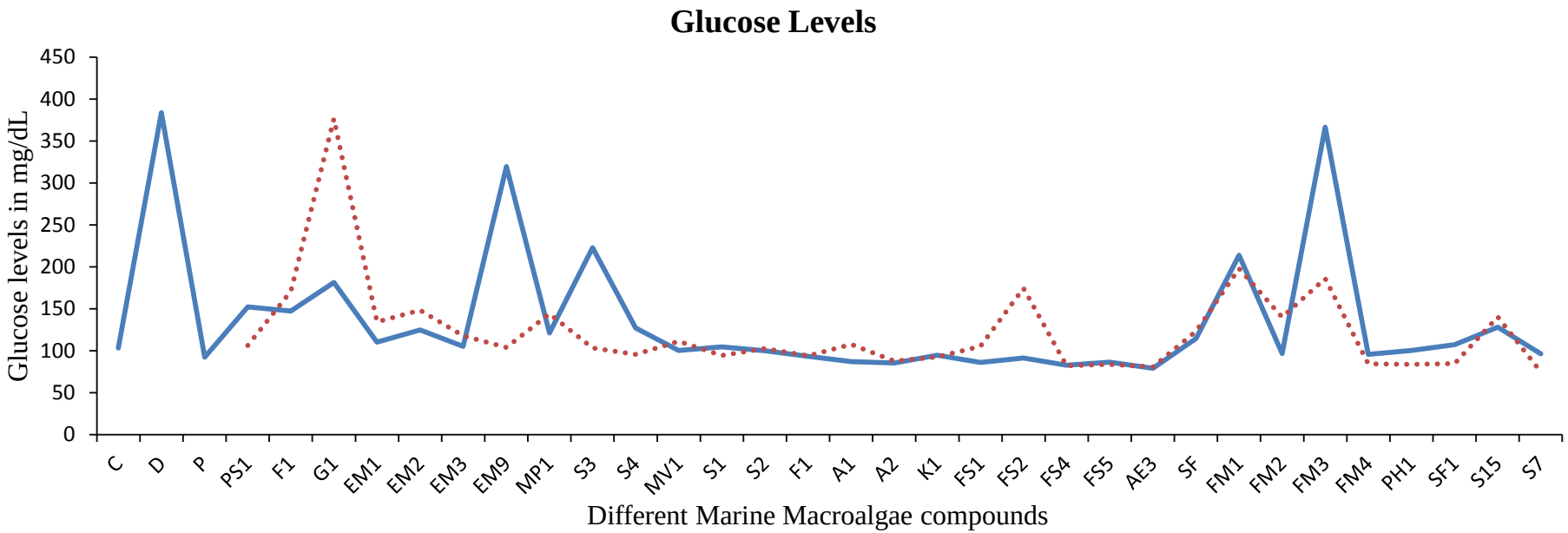

**The experiment was continued for 21 days**

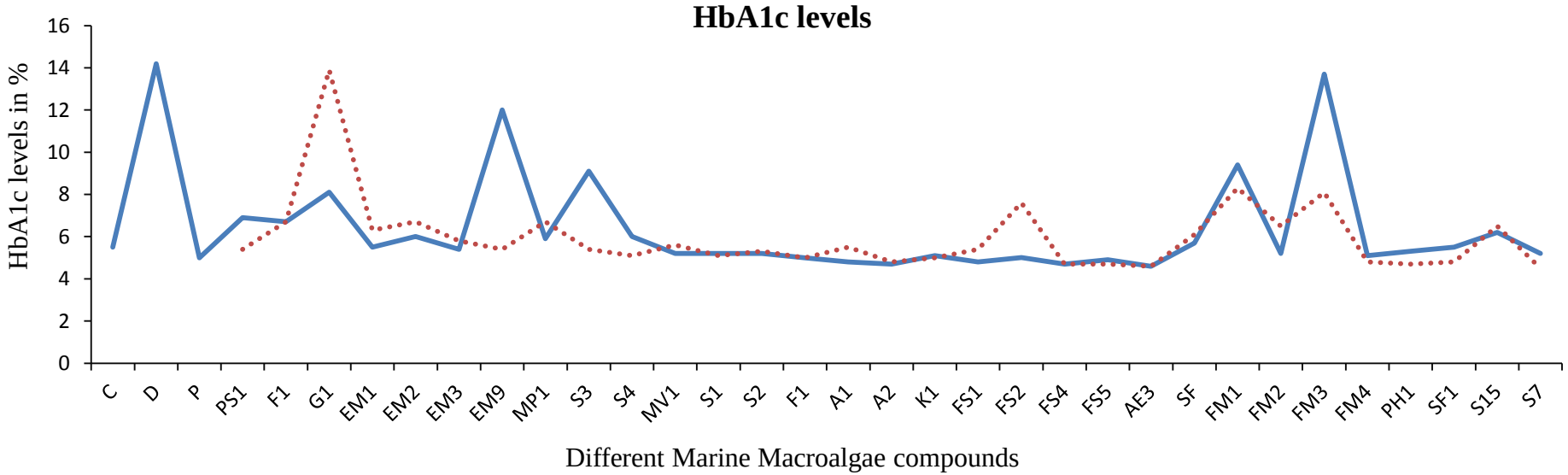
- Estimation of Glucose levels by Accucheck method (Hugget and Nixson, 1957)
- Estimation of glycosylated hemoglobin by HbA1c assay (Karunanayake and chandrasekar, 1985)

## BIOCHEMICAL ANALYSIS

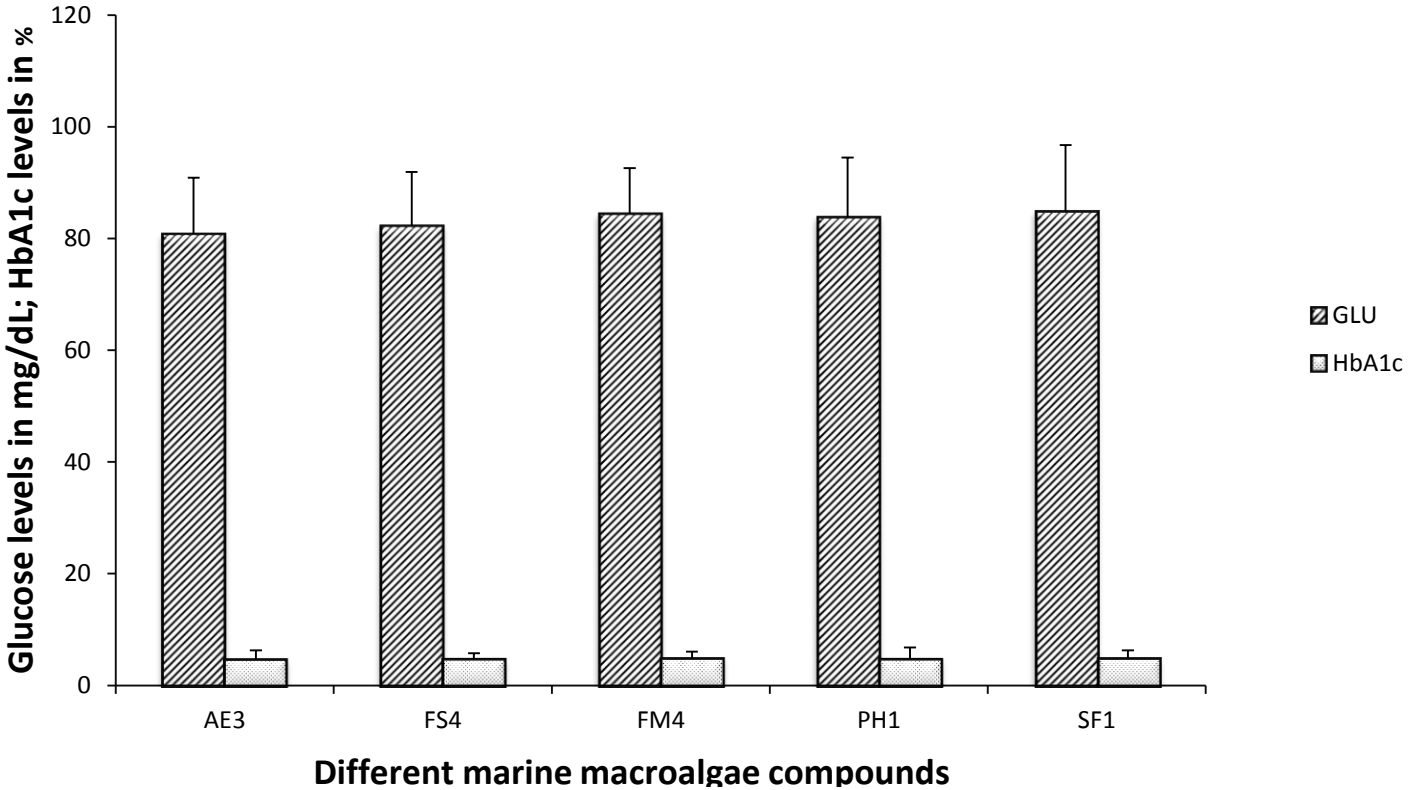
- Assay of superoxide dismutase (SOD) by Misra and Fridovich, 1972
- Assay of catalase (CAT) by Aebi and Packer, 1984
- Assay of Glutathione Peroxidase (GPx) by Rotruck et al., 1973
- Assay of Glutathione-S-Transferase (GST) by Habig et al., 1974
- Estimation of Reduced glutathione (GSH) by Sedlak and Lindsay 1968
- Assay of Lipid Peroxidase (LPx) by Hiroshi et al., 1979

# RESULTS


Glucose Levels
Glucose levels in mg/dL
450
400
350
300
250
200
150
100
50
0
C D P PS1 F1 G1 EM1 EM2 EM3 EM9 MP1 S3 S4 MV1 S1 S2 F1 A1 A2 K1 FS1 FS2 FS4 FS5 AE3 SF FM1 FM2 FM3 FM4 PH1 SF1 S15 S7
Different Marine Macroalgae compounds


HbA1c levels
HbA1c levels in %
16
14
12
10
8
6
4
2
0
C D P PS1 F1 G1 EM1 EM2 EM3 EM9 MP1 S3 S4 MV1 S1 S2 F1 A1 A2 K1 FS1 FS2 FS4 FS5 AE3 SF FM1 FM2 FM3 FM4 PH1 SF1 S15 S7
Different Marine Macroalgae compounds

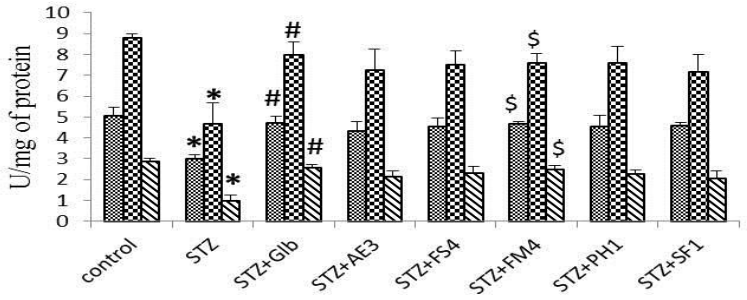
# Selected marine macroalgae compounds



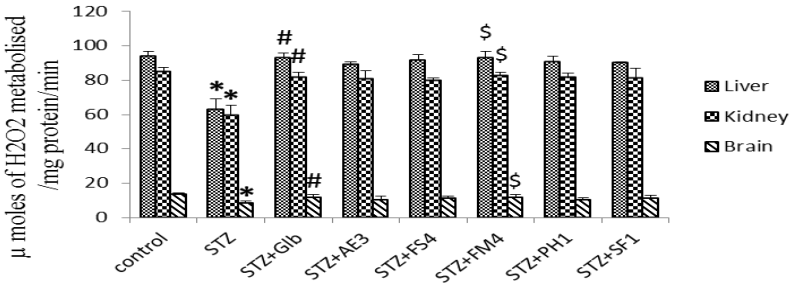
- After screening of 31 marine macroalgae extracts, five extracts (AE3, FS4, FM4, PH1 and SF1) has shown significant changes in blood glucose and HbA1c levels.

- The perturbations of the anti-oxidant enzyme levels were studied by using the selected five potential extracts during STZ-induced diabetic rats.

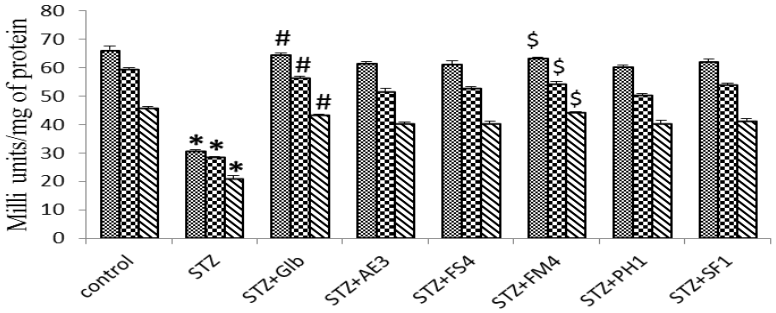
# Antioxidant enzyme levels



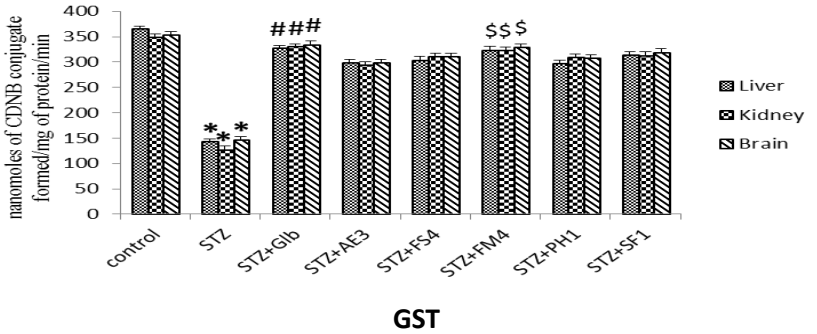

SOD



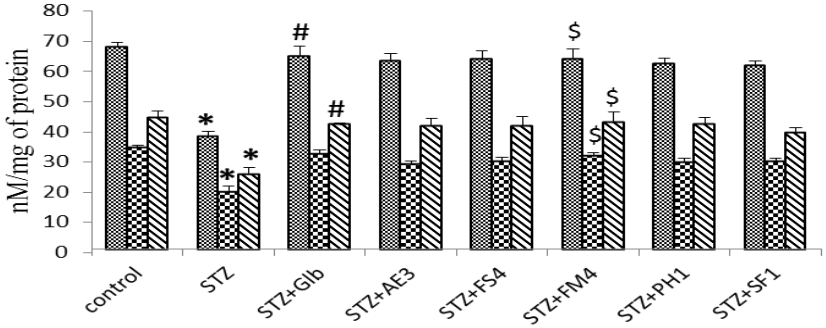

CAT



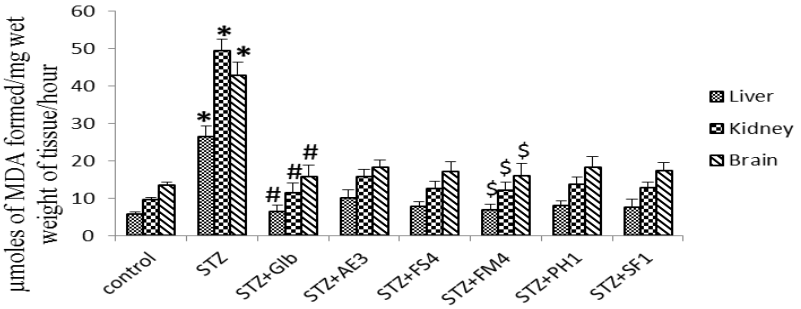

GPx




GST




GSH




LPx

- Based on the antioxidant enzyme activities, glucose, HbA1c levels and solubility of the extracts the results duly revealed that among five potential extracts *G. opuntia* (FM4) (aqueous) showed greater anti-diabetic properties.

# CONCLUSION

- Out of 31 marine macroalgae compounds the ethanolic extract of *T,conoides* (AE3), methanolic extracts of *S.weightii* and *T. conoides* (PH1 and SF1), aqueous extract of *G. Opuntia* (FS4) and *G. opuntia* (FM4) have significantly reduced the glucose, HbA1c and antioxidant enzymes activity levels.

- The crude extracts of marine macroalgae have capability of reducing the diabetes and related oxidative stress.

- Among the different marine macroalgae treatments, aqueous extracts of *G. opuntia* (FM4) showed significantly greater anti-diabetic properties.

# Acknowledgement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Thank you!