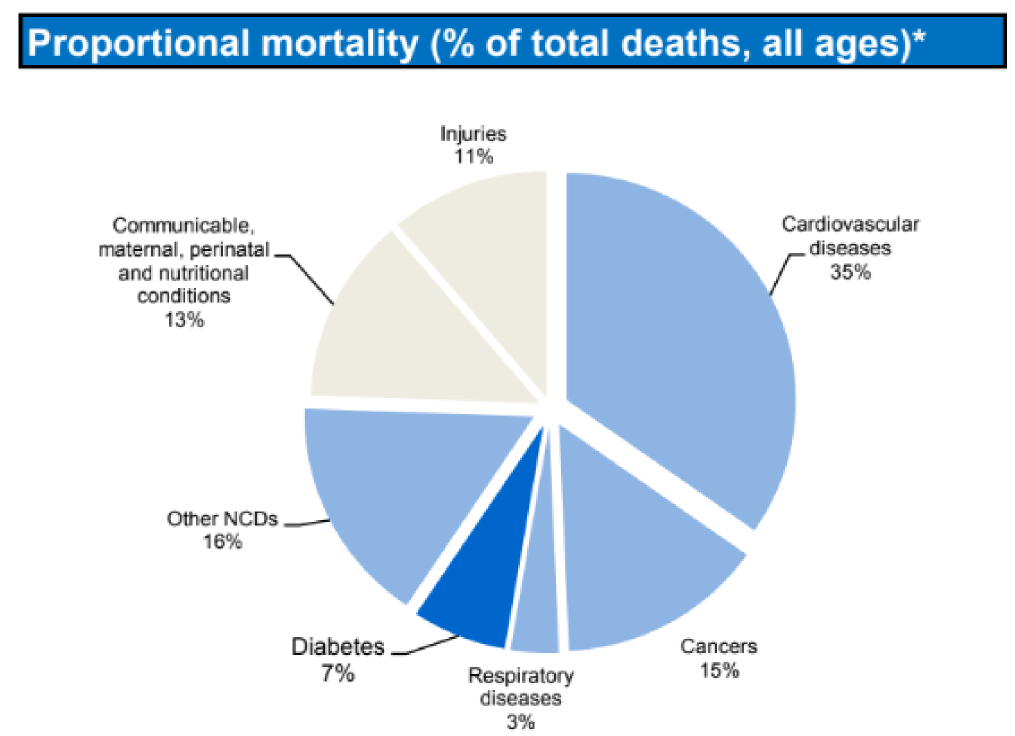
Germinated *Triticum Aestivium* under microgravity : A new candidate for type 1 diabetes therapy

- **Every 10 seconds**, one **person dies** from **diabetes-related complications**.
- **Diabetes mellitus** is a major risk factor for cardiovascular disease which is the first leading cause of death.



- Due to high mortality rate from diabetic complications and current diabetes medications may lead to kidney and liver complications
- we looked for a local natural plant germinated under microgravity to be used as an alternative therapy.

Importance of microgravity studies

- **No** research had been done in therapeutic potential of germinated *Triticum aestivum* under microgravity conditions.

- Although germinated Triticum aestivum under normal condition (under gravity) showed promising results, our results under microgravity conditions showed high concentrations of natural polyphenols and flavonoids with high antioxidant activities.


Methodology

A 3D- clinostat (built in our lab) will be used at different rotations/ minute revolving plants in three-dimensions to create a microgravity conditions.

- Grains of *T. aestivum* will be germinated under gravity and microgravity at 4 rotations/ minute conditions for10 days.

- Suitable amounts of the powdered plant materials will be extracted by soxhlet extraction technique.

The antioxidant activity of the extracts will be evaluated using hydrogen peroxide and nitric oxide scavenging activities.

Diabetes was induced in rats by single intraperitoneal administration of STZ (65 mg/kg body weight). Plant extracts at the doses of 100 mg/kg body weight was orally administered to both diabetic and non-diabetic animals for a period of 24 days. After completion of experimental duration serum, liver and pancreas were used for evaluating biochemical (glucose, insulin , lipid profile, kidney function and liver function parameters) and histopathological changes.


RESULTS

Figure: 1 Total Phenolic content of germinated *Tritium aestivum* grains

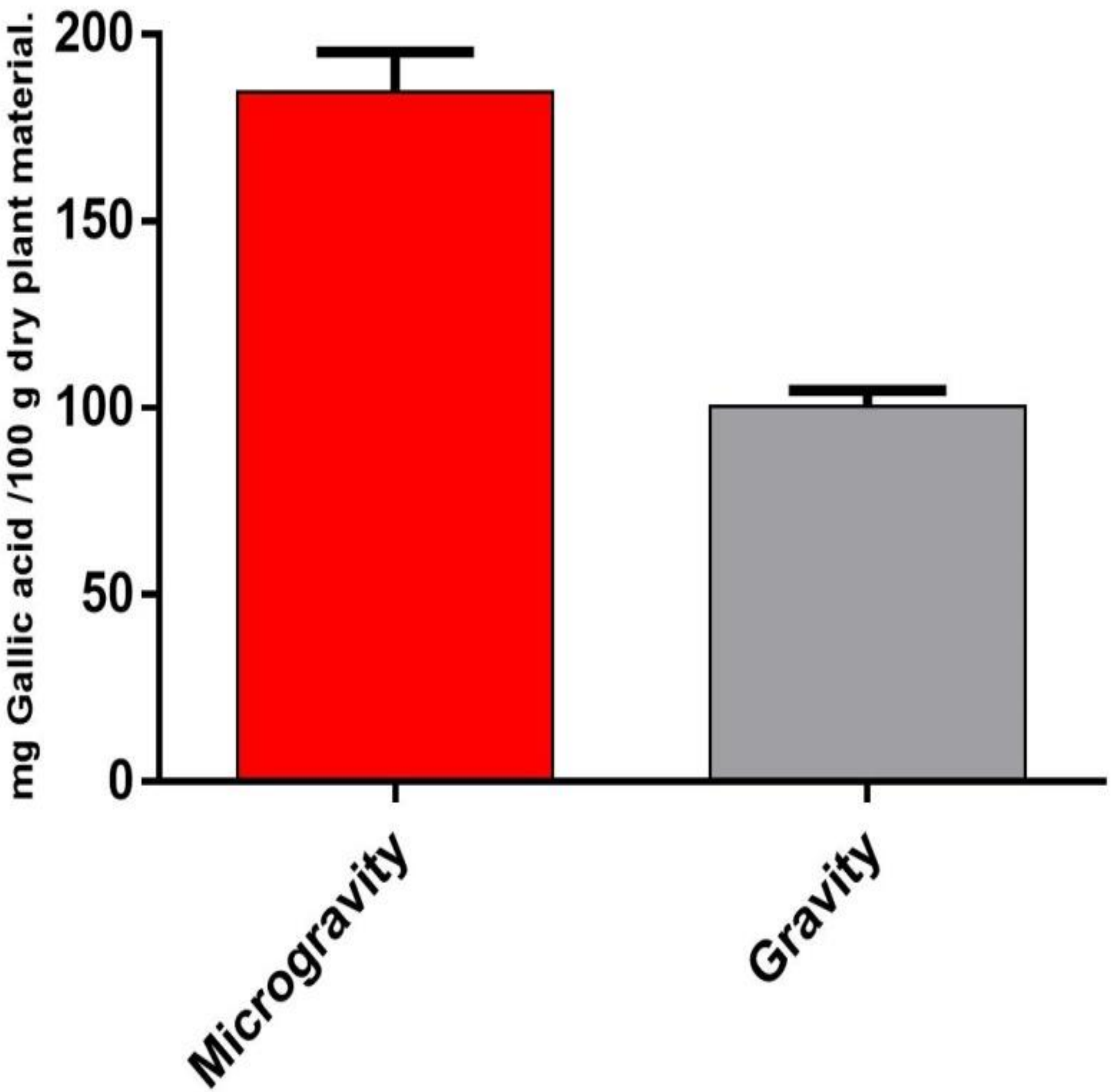


Figure: 2 Total flavonoid content of germinated *Triticum aestivum* grains

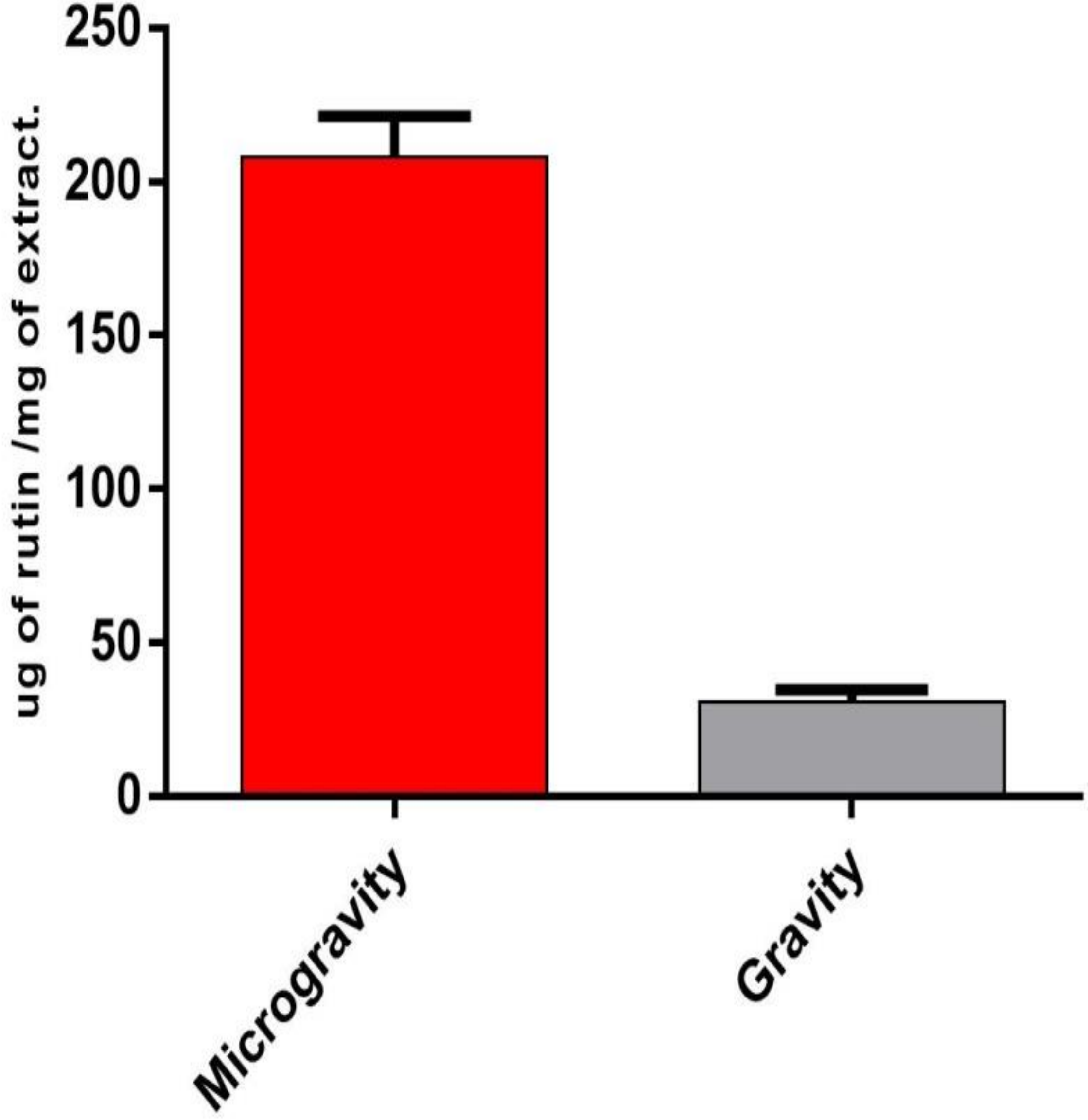
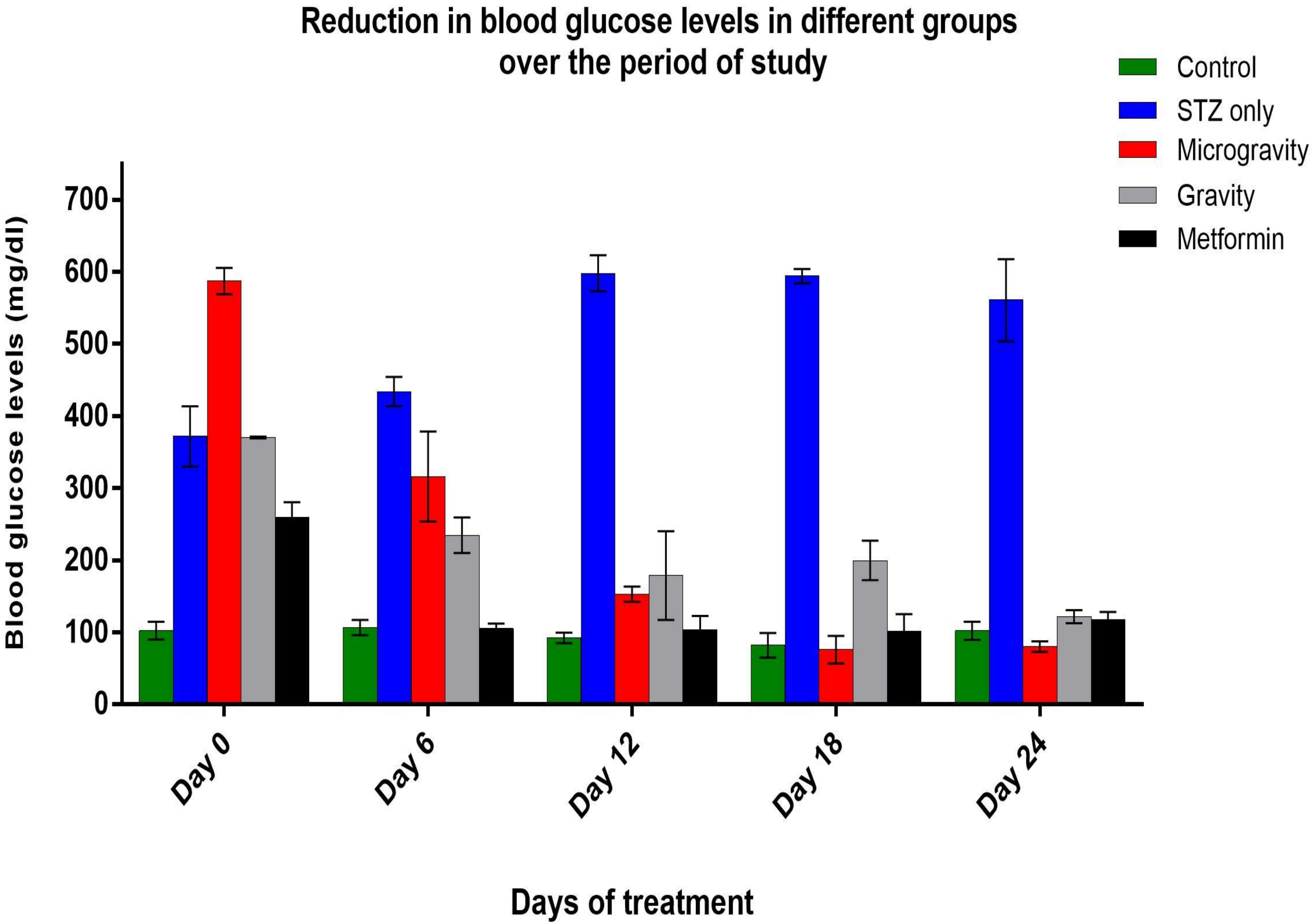


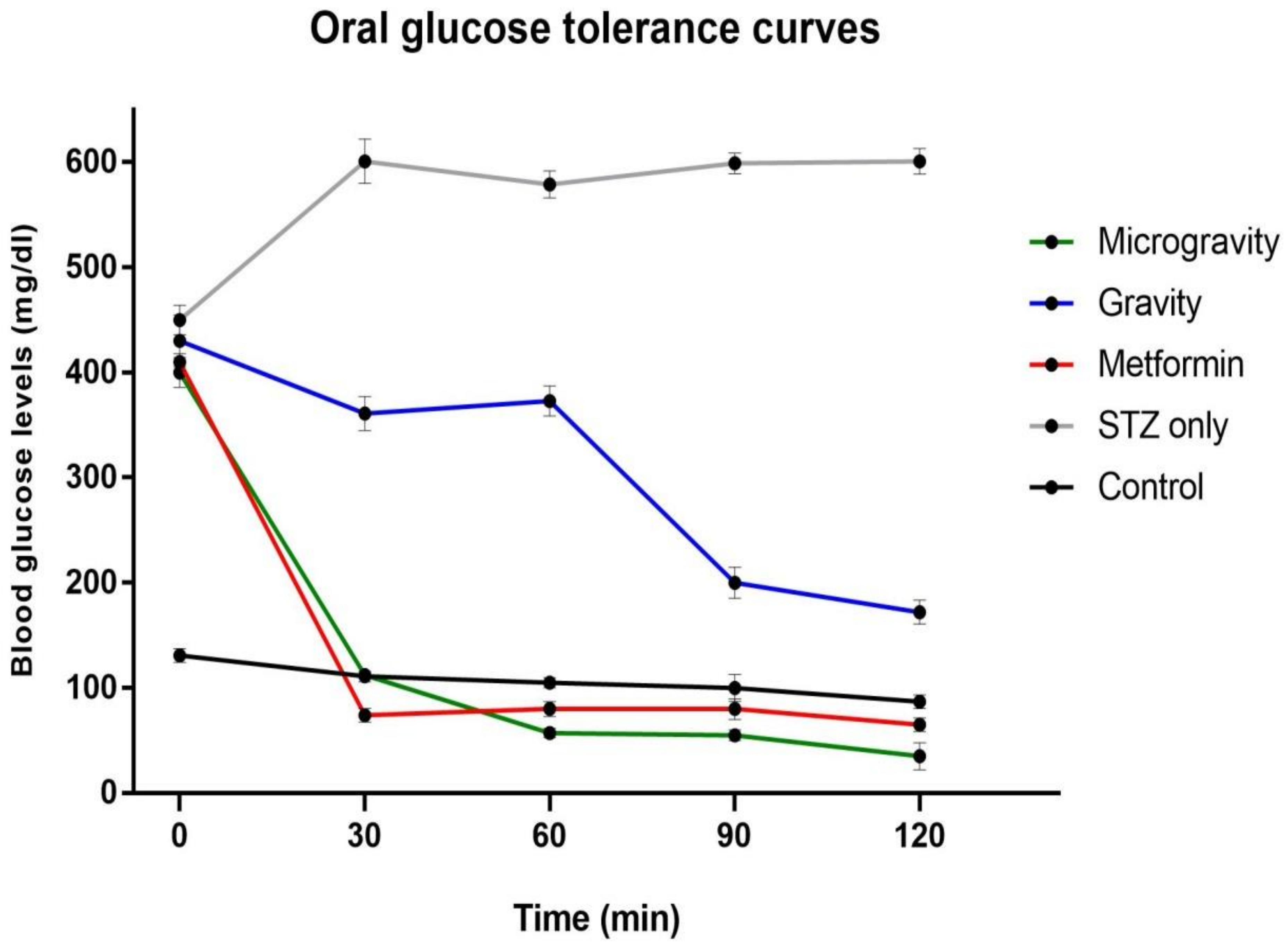
Table 1: Antioxidant Potential of *Triticum aestivum*

Plant extracts	H_2O_2 Scavenging IC_{50} (µg/ ml)	NO-scavenging IC_{50} (µg / ml)
Germinated under Gravity	25±3.9	55±7.68
Germinated under Microgravity	13±5.8	34±4.69
Ascorbic acid	44±2.1	58±2.4

**Values represented in the results are mean±SD (n=3); linear regression analysis was used to calculate IC_{50} value.



Reduction in blood glucose levels in different groups over the period of study
Control
STZ only
Microgravity
Gravity
Metformin
Blood glucose levels (mg/dl)
700
600
500
400
300
200
100
0
Day 0
Day 6
Day 12
Day 18
Day 24
Days of treatment

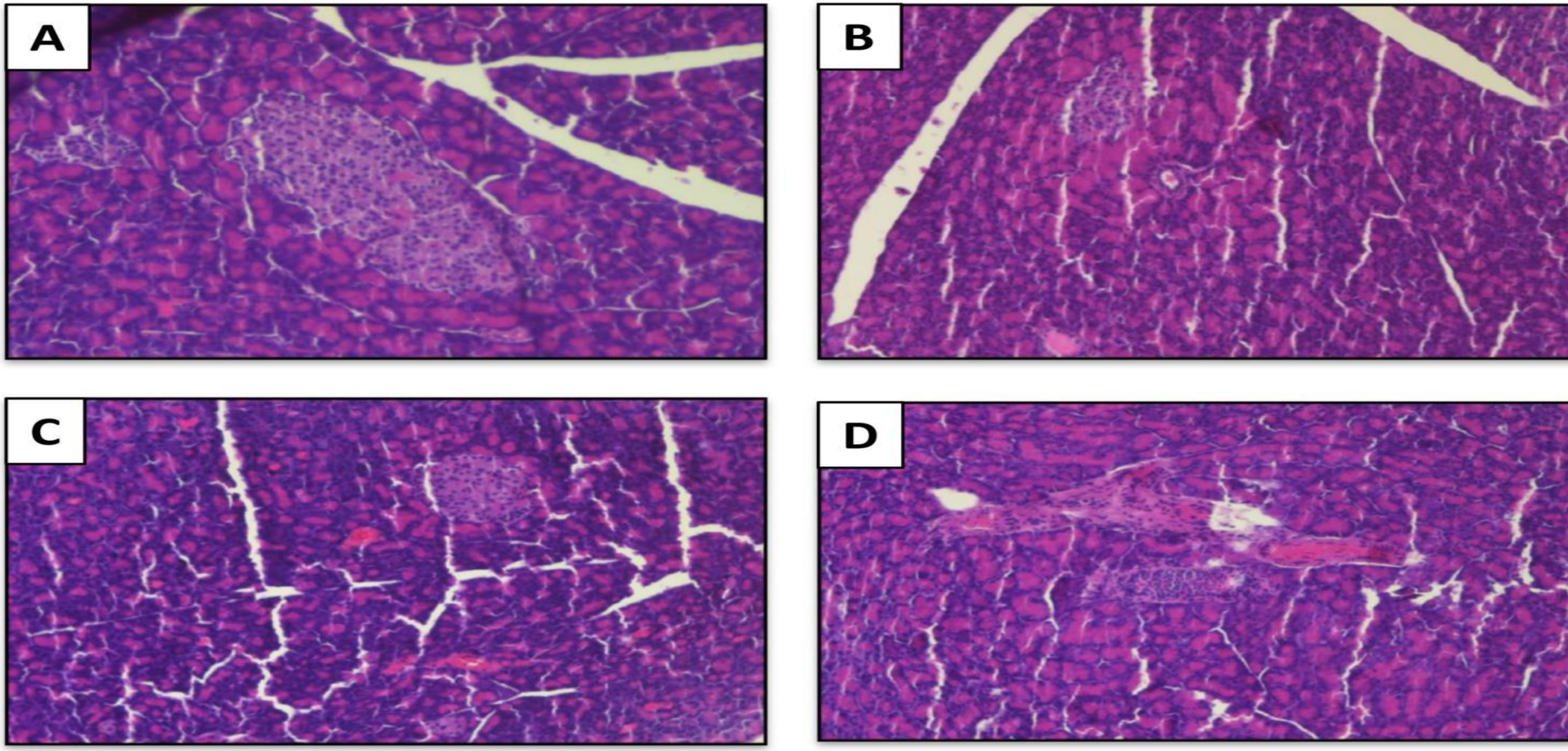

Oral glucose tolerance curves
Blood glucose levels (mg/dl)
600
500
400
300
200
100
0
0
30
60
90
120
Time (min)
Microgravity
Gravity
Metformin
STZ only
Control

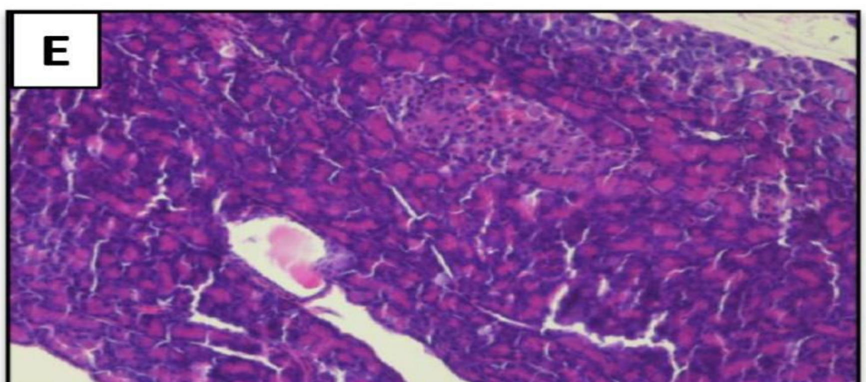
Effect of germinated *Triticum aestivum* on the lipid profile, liver functions and kidney function parameters

Test	Control	STZ only	Microgravity	Gravity	Metformin
Triglycerides	0.63±0.08	0.85±0.17	0.6±0.15	0.55±0.06	0.6±0.1
cholesterol	1.68±0.19	2.18±0.34	1.75±0.31	1.86±0.33	1.64±0.14
HDL	0.98±0.06	1.47±0.24	1.14±0.12	1.14±0.10	0.97±0.04
LDL	1.08±0.29	2.06±0.35	1.11±0.19	1.16±0.62	1.31±0.13
creatinine	34.4±0.13	100.6±8.50	37.8±2.03	43.2±1.43	34.1±1.08
urea	6±0.8	25.8±2.3	10.6±1.2	9.1±2.1	8.2±1.7
SGOT	129±10.2	373.5±16.3	132.4±11.6	160.5±17.2	158.6±14.3
SGPT	63±4.20	210.7±14.1	45.2±3.60	59.4±6.10	62.3±7.20

Effect of germinated *Triticum aestivum* on the glycosylated hemoglobin, insulin and C-peptide levels

Group	Glycosylated Hemoglobin (HbA1C) %	Insulin (µLU/mL)	C-peptide (ng/mL)
Control	5.55±0.21	2.6±0.2	0.047±0.0032
Microgravity	5.45±0.33	3.04±0.35	0.053±0.0022
Gravity	6.02±0.23	2.4±0.12	0.040±0.0021
Metformin	5.65±0.14	2.54±0.21	0.045±0.0010
Streptozotocin	8.85±0.24	1.2±0.03	0.039±0.0015





A: Control
B: STZ
C: Microgravity
D: Gravity
E: Metformin


Conclusion
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- Our results in germinated *Triticum aestivum* under microgravity showed a promising new drug without any side effects and with less manufacturing cost for diabetic treatment.
- This method can be used to explore the therapeutic potential for other diseases.


Thank you

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