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EFFECT OF BOERHAAVIA DIFFUSA HOMEOPATHIC MOTHER TINCTURE ON CELLULAR GLUCOSE UTILIZATION: AN IN-VITRO STUDY

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ABSTRACT

Herbal mother tinctures, used in homeopathy, are alcohol-based hydro-ethanolic extracts that may retain pharmacologically active plant constituents [1,9,10]. Boerhaavia diffusa, traditionally used for its diuretic, hepatoprotective, and anti-diabetic properties [1,2,3,11], was investigated in this study for its effect on glucose uptake in L6 skeletal muscle cells. The mother tincture was applied in concentrations equivalent to 25, 50, and 100 µg/mL. Glucose uptake was quantified using the glucose oxidase-peroxidase (GOD-POD) method [7,8] after a 24-hour incubation under high-glucose conditions. A dose-dependent increase in glucose uptake was observed, suggesting that Boerhaavia diffusa mother tincture may promote glucose utilization in muscle cells. These findings support its potential role in complementary diabetes management.

KEYWORDS

Boerhaavia diffusa, mother tincture, glucose uptake, L6 cell line, diabetes, homeopathy, skeletal muscle

1. INTRODUCTION

Diabetes mellitus, particularly type 2 diabetes, is characterized by chronic hyperglycemia due to insulin resistance and impaired glucose uptake, especially in skeletal muscle [5]. Traditional and complementary systems of medicine, including homeopathy, utilize plant-based remedies to manage metabolic disorders. Among them, Boerhaavia diffusa (family: Nyctaginaceae), known as 'Punarnava,' is traditionally recognized for its anti-inflammatory, diuretic, and antidiabetic potential [1–3,11]. Homeopathic mother tinctures, prepared through maceration of plant material in alcohol [9], are used as base remedies and are often pharmacologically active due to the presence of crude plant constituents [10]. This study evaluates the in vitro glucose uptake activity of Boerhaavia diffusa mother tincture in L6 rat skeletal muscle cell lines to assess its potential in enhancing peripheral glucose utilization [2,5,6].

2. MATERIALS AND METHODS

2.1 Chemicals and Reagents

• Boerhaavia diffusa Mother Tincture (obtained from a certified homeopathic pharmacy)
• DMEM (Dulbecco's Modified Eagle Medium), Sigma-Aldrich
• Fetal Bovine Serum (FBS)
• L-glutamine, sodium bicarbonate (Merck)
• Penicillin (100 U/mL), Streptomycin, Amphotericin B
• Trypsin-EDTA solution (0.025%)
• Glucose Oxidase Kit (Coral Clinical Systems, Lot No: RGLU1091) [7,8]
• Cell lysis buffer: 1 M Tris-HCl, 0.25 M EDTA, 2 M NaCl, 0.5% Triton X-100

2.2 Cell Line and Culture

L6 rat skeletal muscle cells were procured from the National Centre for Cell Sciences (NCCS), Pune, India. Cells were cultured in DMEM supplemented with 10% FBS, L-glutamine, sodium bicarbonate, and antibiotics. Cultures were maintained at 37 °C in a humidified 5% CO_2 atmosphere [5].

2.3 Experimental Procedure

L6 cells were seeded into 24-well plates and allowed to reach ~80% confluency.
Cells were starved in glucose-free DMEM for 24 hours.
The Boerhaavia diffusa mother tincture was diluted in sterile medium to prepare final concentrations equivalent to 25, 50, and 100 µg/mL.
Treated cells were incubated in high-glucose DMEM (300 mM glucose) with the respective concentrations of mother tincture for 24 hours.
An untreated control group (300 mM glucose, no tincture) was maintained.
After incubation, cells were collected by centrifugation at 6000 rpm for 10 minutes.
The cell pellet was lysed using 200 µL of lysis buffer and kept at 4 °C for 30 minutes.
Glucose concentration in the lysates was measured using the GOD-POD method as per the glucose oxidase kit instructions [7,8].
All experiments were performed in triplicates, and mean values were used.

3. CALCULATIONS

• Total Glucose (mg/dL) = (Absorbance of Test / Absorbance of Standard) × 100
• % Glucose Uptake = (OD of Test – OD of Control) / OD of Test × 100

4. RESULTS

Table 1: Glucose Uptake Observations

Concentration (µg/mL)	Absorbance (OD)	Glucose (mg/dL)	% Glucose Uptake
Control	0.0903	22.6998	–
25	0.1210	30.4173	25.37%
50	0.1856	46.6566	51.34%
100	0.2627	66.0382	65.62%

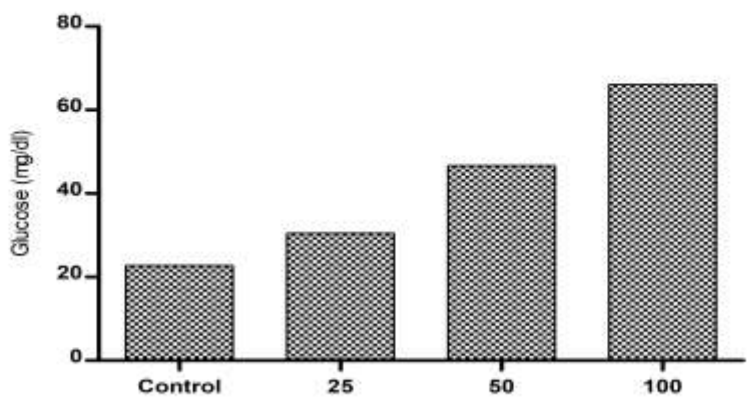

Figure 1: Glucose Concentration vs. Mother Tincture Dose

Graphical representation depicting the glucose level of sample . Along Y axis glucose level, Along X axis varied concentration of sample

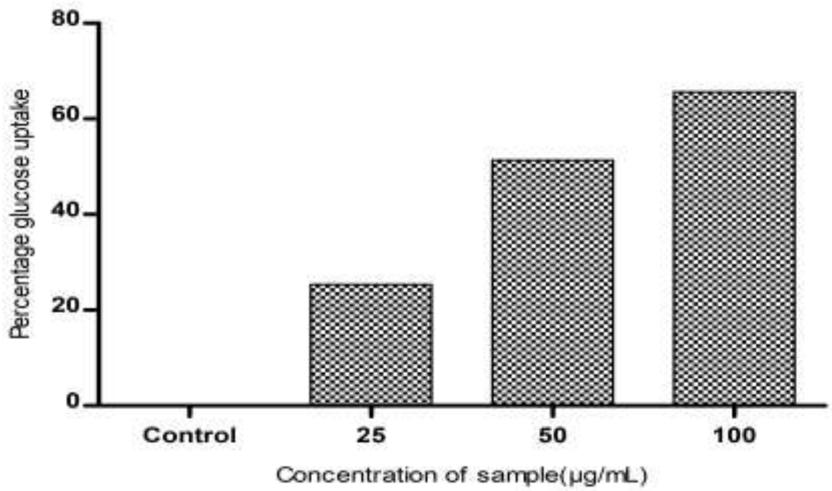

Figure 2: Percentage Glucose Uptake vs. Mother Tincture Dose

Graphical representation depicting the percentage glucose uptake of sample. Along Y axis percentage glucose uptake, Along X axis varied concentration of sample

5. DISCUSSION

The results demonstrate a dose-dependent increase in glucose uptake in L6 muscle cells following treatment with Boerhaavia diffusa mother tincture [2,5,6]. The highest glucose uptake was observed at 100 µg/mL, indicating the potential of the tincture to enhance peripheral glucose utilization [2]. The activity observed may be due to active phytoconstituents such as punarnavine, boeravinone, and flavonoids present in the tincture [1,4,11], which could enhance glucose transporter activity or mimic insulin action [5,6]. Previous studies have shown that Boerhaavia diffusa modulates enzymes related to carbohydrate metabolism and possesses antioxidant properties [2,4,11], which may contribute to improved glucose uptake. This study provides evidence that mother tinctures, although prepared with alcohol and serial dilution [9,10], retain pharmacological effects that can be quantified in vitro [10].

6. CONCLUSION

This study indicates that the mother tincture of Boerhaavia diffusa significantly enhances glucose uptake in cultured L6 skeletal muscle cells in vitro under high-glucose conditions [2,5,6]. These findings validate the traditional use of this plant in diabetes and suggest that mother tinctures can have measurable biological effects at the cellular level [1,9,10]. Further studies, including in vivo evaluations and mechanistic assays, are recommended [2,5].

7. REFERENCES

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