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Effect of methanolic corm extract of Colocasia esculenta on food intake: An anti-obesity study

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Abstract

Obesity is a global epidemic associated with metabolic disorders, cardiovascular diseases, and reduced life expectancy. Current pharmacological therapies are limited by adverse effects, prompting interest in plant-based alternatives. The objective was to evaluate the anorectic effect of methanolic corm extract of *Colocasia esculenta* in Swiss albino mice. Corms were extracted using Soxhlet apparatus with methanol. Phytochemical screening and total phenolic content (Folin-Ciocalteu assay) were determined. Acute toxicity was assessed at 2000 mg/kg. Female Swiss albino mice were divided into six groups: vehicle, extract (0.1 and 0.2 g/kg), fluoxetine, 8-OH-DPAT, and 8-OH-DPAT + extract. Food intake was measured at 0.5–4 h post-treatment. The extract yield was 16.21% w/w. Phytochemical analysis revealed alkaloids, saponins, flavonoids, phenolics, and terpenoids. Total phenolic content was 182.93 mg GAE/g. No mortality was observed in toxicity studies. The extract reduced food intake dose-dependently (2.57 g at 0.1 g/kg; 2.12 g at 0.2 g/kg vs. 3.17 g in controls, $p<0.05$). Fluoxetine produced maximal suppression (1.29 g), while 8-OH-DPAT induced hyperphagia (3.74 g). Co-administration attenuated hyperphagia (3.05 g). The study led the authors to conclude that the methanolic corm extract of *C. esculenta* exhibits safe, dose-dependent anorectic activity, likely mediated via serotonergic pathways, supporting its potential as a natural anti-obesity agent.

Keywords: Obesity, anorexia, *Colocasia esculenta*, extract, Serotonergic

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Introduction

Obesity is a chronic metabolic disorder characterized by excessive accumulation of body fat due to an imbalance between energy intake and expenditure. It is recognized as a major global health problem, contributing to reduced life expectancy and increased risk of non-communicable diseases such as type 2 diabetes, cardiovascular disease, musculoskeletal disorders, and certain cancers (WHO, 2025; Lin & Li, 2021). The World Health Organization (WHO) reports that worldwide obesity has nearly tripled since 1975, with more than 650 million adults classified as obese in 2016, and an estimated 167 million people projected to become less healthy due to overweight or obesity by 2025 (WHO, 2025).

In India, the prevalence of overweight and obesity is rising faster than the global average, largely due to sedentary lifestyles and dietary transitions (Behla & Misra, 2017). Obesity not only imposes a significant health burden but also contributes to economic challenges, with medical costs for obese individuals being approximately 30% higher than those with normal weight (Withrow & Alter, 2011).

Current therapeutic strategies for obesity include caloric restriction, exercise, bariatric surgery, and pharmacological interventions. However, synthetic drugs such as sibutramine and rimonabant have been withdrawn due to adverse cardiovascular and psychiatric effects (James et al., 2010; Fink & Gothert, 2007). Orlistat, lorcaserin, phentermine/topiramate, naltrexone/bupropion, and liraglutide remain available, but their efficacy is limited and side effects remain a concern (Hvizdos & Markham, 1999; Thomsen et al., 2008; Croft et al., 2002; Daneschvar et al., 2016).

Given these limitations, there is growing interest in herbal medicines as safer, cost-effective alternatives. Natural products have demonstrated anti-obesity potential through mechanisms such as pancreatic lipase inhibition, appetite suppression, energy expenditure stimulation, and inhibition of adipocyte differentiation (Birari & Bhutani, 2007; Mopuri & Islam, 2017). *Colocasia esculenta* (taro), a tuberous plant belonging to the family Araceae, is traditionally used for its nutritional and medicinal properties, including antioxidant, antidiabetic, and hepatoprotective activities (Lad et al., 2023; Kubal et al., 2023). Despite its phytochemical richness, the anti-obesity potential of *C. esculenta* corm extract has not been extensively studied.

The present investigation was therefore undertaken to evaluate the anorectic effect of methanolic corm extract of *Colocasia esculenta* in Swiss albino mice, with a focus on its ability to modulate food intake and its possible serotonergic involvement.

Material and Methods

Colocasia esculenta corm was purchased from local vegetable sellers of Bhopal. The corm was washed with distilled water, dried under shade and powdered using a blender at low speed. The powdered

corm was sieved to remove any unwanted debris and were stored in air tight container until taken for use.

Extraction of corm

84.5 g of corm powder was evenly packed in the extractor of the soxhlet apparatus and subjected to defatting with petroleum ether followed by extraction with methanol using hot continuous extraction for 7 h. The extract was filtered while hot through Whatman filter paper to remove any impurity. The extracts were concentrated by distillation to reduce the volume to one-tenth. The concentrated extracts were transferred to 100 ml beaker and the remaining solvents were evaporated on water bath. The oleo-resinous extracts were collected and placed in desiccators to remove the excessive moisture**.** The dried extracts were stored in desiccators for further processing (Sahira Banu and Cathrine, 2015).

Preliminary phytochemical screening

The ethanolic extract was evaluated by qualitative phytochemical screening in order to identify the type of plant secondary metabolites present in them. The screening was performed for triterpenes/steroids, alkaloids, glycosides, flavonoids, saponins, tannins, and phenolic acids. The color intensity or the precipitate formation during the testing was used as analytical responses to these tests (Arora and Arora, 2019).

Total Phenolic Content

0.1 g dried extract was mixed with 8.0 mL of methanol and kept overnight. The suspension was filtered through a qualitative cellulose filter paper and the filtrate was diluted to 10 mL with methanol. The solution was stored at 4°C in amber bottles and served as the stock solution (50 mg/mL) for subsequent analyses. For total phenolic content determination, 200 µL of sample was mixed with 1.4 mL purified water and 100 µL of Folin-Ciocalteu reagent. After at least 30 s (but not exceeding 8 min), 300 µL of 20% Na_2CO_3 aqueous solution was added and the mixture allowed to stand for 2 h. The absorbance was measured at 765 nm with a UV-Vis spectrophotometer. Standard solutions of gallic acid (10-100 ppm) were similarly treated to plot the analytical curve. The control solution contained 200 µL of methanol and suitable reagents, and it was prepared and incubated under the same conditions as the rest of the samples. Results were expressed as milligrams of gallic acid equivalent (GAE) per 100 g of the dry sample (Fapetu et al., 2025).

Pharmacological evaluation of anti-obesity potential

Animals Used

Female Swiss albino mice weighing 20–25 g, were housed six per cage with free access to food and water at laboratory conditions. The animals were used following at least a 2-day period of adaptation to the laboratory conditions. The experiments were carried out between 10.00 and

17.00 h at room temperature (22 ± 2 °C). All the experimental protocols have been approved by the Institutional Animals Ethics Committee and conducted according to the Indian National Science Academy Guidelines on the Use and Care of Experimental Animals.

Drugs Used and Grouping of Animals

The extract was suspended in distilled water and administered at a dose of 0.1 g/kg, p. o. and 0.2g/kg, p.o. Fluoxetine HCl and (±)-8-Hydroxy-2-(dipropylamino)tetralin hydrobromide (± 8-OH-DPAT) were dissolved in distilled water. Both these drugs were administered intraperitoneally at constant volume of 1 ml/100 g body weight.

Group-1 (Vehicle control): Normal mice which developed in normal condition and give normal diet.; Group-2 (Extract treatment): Mice administered with 0.1g/kg, p.o extract suspension; Group-3 (Extract treatment): Mice administered with 0.2g/kg, p.o extract suspension; Group-4 (Fluoxetine treatment): This group served as standard and administered with fluoxetine solution (10 mg/kg, intraperitoneally); Group-5 (± 8-OH-DPAT pretreatment): Mice administered with ± 8-OH-DPAT (0.1 mg/kg, intraperitoneally); Group-6 (± 8-OH-DPAT pretreatment): Mice treated with ± 8-OH-DPAT 30 minutes prior to administration of extract 0.2g/Kg

Study of effect of extract on food intake

Mice were kept in groups of six in test cages and included a vehicle-treated control group and the various drug treatment groups. The food and water were withheld 1 h before the experimentation. Extract was administered orally and after 15 min preweighed sweetened chow (5 g) was presented to the different groups of mice in petri dishes in the test cages. The amount remaining was weighed after 0.5, 1, 2, 3 and 4 h intervals and the cumulated food intake/mouse (g/20 g body weight) was calculated (Kaur and Kulkarni, 2001).

Study of effect of fluoxetine on food intake

As done with SS, mice were kept in groups of six in test cages and included a vehicle-treated control group and the various drug treatment groups. The food and water were withheld 1 h before the experimentation. Fluoxetine hydrochloride was administered intraperitoneally and after 15 min preweighed sweetened chow (5 g) was presented to the different groups of mice in petri dishes in the test cages. The amount remaining was weighed after 0.5, 1, 2, 3 and 4 h intervals and the cumulated food intake/mouse (g/20 g body weight) was calculated.

Study of effect of ± 8-OH-DPAT pretreatment food intake ability by extract

The food and water were withheld 1 h before the experimentation. 8-OH-DPAT (0.1 mg/kg, i. p.) was administered intraperitoneally to the animals and after 15 min preweighed sweetened chow (5 g) was presented to the different groups of mice in petri dishes in the test cages. The amount

remaining was weighed after 0.5, 1, 2, 3 and 4 h intervals and the cumulated food intake/mouse (g/20 g body weight) was calculated.

Study of effect of ± 8-OH-DPAT pretreatment food intake ability by extract

The food and water were withheld 1 h before the experimentation. 8-OH-DPAT (0.1 mg/kg, i.p.) was administered intraperitoneally to the animals. After 30 min, extract was administered to these animals and after 15 min preweighed sweetened chow (5 g) was presented to the different groups of mice in petri dishes in the test cages. The amount remaining was weighed after 0.5, 1, 2, 3 and 4 h intervals and the cumulated food intake/mouse (g/20 g body weight) was calculated.

Results and Discussion

Extraction and phytochemical screening

The methanolic extraction was carried out using hot continuous extraction method. The extract obtained was dark brown in color, sticky solid. The yield of the extract was found to be 13.7 g (16.21% w/w) of the dry corm powder. The results of preliminary phytochemical screening of the extract suggest the presence of alkaloids, saponins, phenolics, flavonoids, and terpenes in the corm extract.

Total Phenolic Content

The extract was evaluated for quantifying the total phenolic content concentrations in extracts. Standard curve of gallic acid was calculated and plotted in distilled water for determining absorption data. The total phenolic content in extract is expressed as gallic acid equivalents. The total phenolic content of hydro-alcoholic extract of *C. esculenta* was 182.93 GAE mg/g.

Acute Toxicity Study

The acute toxicity test was performed by using the dried extract at concentration of 2000 mg/kg to the test animal, administered orally. No animal died and hence the dose of upto 2000 mg/Kg was considered to be safe. As none of the animals died, the LD_{50} was considered to be more than 2000 mg/Kg and any dose less than 2000 mg/Kg would be considered for evaluation of antiobesity studies.

Anti-obesity action

The ability of rodent to consume sweetened chow or high fat diet is a highly effective model for study of anti-obesity action of drugs. A standard chow died provides 12.98% fat energy, 58.62% carbohydrates and 28.40% proteins, contributing to total of 1243.6 kcal/100g. On the contrary, a high fat diet (sweetened chow) usually contains 50.52% fat, 31.50% carbohydrates, and 17.98% proteins, contributing to 1765.8 kcal/100g.

The anti-obesity effect of the extract was assessed by observing the effect of the extract on the food intake habit of experimental mice. The amount of food remained unconsumed post 4 hours

of treatment in each group was weighed and the food intake in grams was calculated per 20 g body weight (Figure 1 and 2).

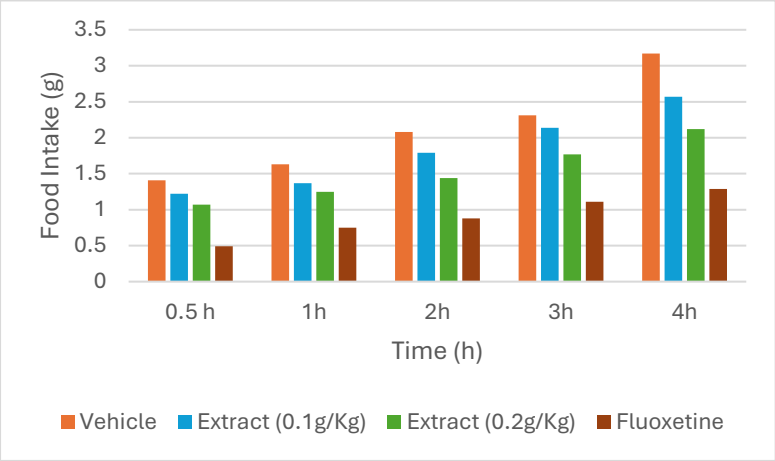

Figure 1 Effect of extract and fluoxetine on food intake in mice

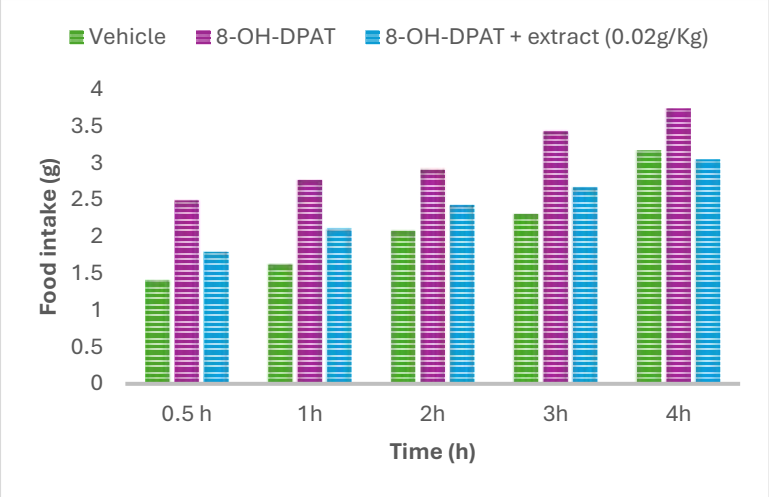

Figure 2 Effect of co-administration of (±) - 8- OH-DPAT + extract on food intake in mice

Mice receiving vehicle treatment showed a progressive increase in cumulative food intake over the 4-hour observation period, reaching 3.17 g/20 g body weight. This served as the baseline control for comparison.

The extract produced a dose-dependent reduction in food intake. At 0.1 g/kg, cumulative intake was significantly lower than vehicle at 4 hours (2.57 g vs. 3.17 g; $p<0.05$). The higher dose (0.2 g/kg) produced a more pronounced suppression, with intake reduced to 2.12 g at 4 hours ($p<0.01$ vs. vehicle). These findings indicate anorectic activity of the extract. This suggests that the extract possesses anorectic properties, potentially mediated through serotonergic pathways, consistent with prior reports of plant-derived compounds influencing satiety.

Fluoxetine treatment resulted in the greatest suppression of food intake across all time points. By 4 hours, intake was reduced to 1.29 g, representing a highly significant decrease compared to vehicle ($p<0.001$). This confirms the expected anorectic effect of fluoxetine.

In contrast, 8-OH-DPAT markedly increased food intake, with mice consuming 3.74 g at 4 hours, significantly higher than controls ($p<0.01$). This hyperphagic effect is consistent with the compound's role as a 5-$HT1_A$ receptor agonist, which reduces serotonergic tone and thereby promotes feeding (Vickers et al., 1999).

Interestingly, co-administration of 8-OH-DPAT with a low dose of extract (0.02 g/kg) attenuated the hyperphagic response. Food intake in this group (3.05 g at 4 hours) was lower than 8-OH-DPAT alone but higher than extract alone. This suggests that the extract partially counteracts the orexigenic effect of 8-OH-DPAT, possibly through receptor modulation or downstream signaling interactions.

The reduction in food intake was calculated with reference to the food intake exhibited by hyperphagic animals (Table 1).

Table 1 Percent reduction in food intake by treated animals

	Percent reduction in food intake as compared to 8-OH-DPAT				
Treatment	**0.5 h**	**1h**	**2h**	**3h**	**4h**
8-OH-DPAT + extract	28.11	23.83	16.49	22.16	18.45

Conclusion

The present study demonstrates that methanolic corm extract of *Colocasia esculenta* significantly suppresses food intake in mice in a dose-dependent manner. The extract was found to be safe up to 2000 mg/kg and contained bioactive phytochemicals including flavonoids, phenolics, alkaloids, and terpenoids. Its anorectic effect, comparable to fluoxetine and partially counteracting 8-OH-DPAT-induced hyperphagia, suggests serotonergic involvement in appetite regulation. These findings highlight the potential of *C. esculenta* as a natural therapeutic candidate for obesity management. Further mechanistic studies and clinical validation are warranted to establish its translational relevance.

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