ORIGINAL ARTICLE

# Anti-adiposity effect of cipó-cravo (*Tynanthus fasciculatus*), a vine from the Brazilian Atlantic Forest

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## ABSTRACT

*Tynanthus fasciculatus* (Vell.) Miers (Bignoniaceae) is a plant used in traditional medicine in southeastern Brazil, with aphrodisiac, antiparasitic, and tonic effects. Its extracts have a range of categories of active compounds identified, but their effects are scarcely reported in the scientific literature. We described, for the first time, the effects of *T. fasciculatus* infusion on body weight and adipose tissue depot weight in a Swiss mouse model. All studied doses (100, 200, and 300 mg/kg) caused a significant reduction in the weight of the interscapular brown adipose tissue and the epididymal white adipose tissue depots. The doses of 100 and 200 mg were also effective in controlling body weight gain. The infusion of *T. fasciculatus* was efficient in reducing adiposity and controlling weight gain.

**Keywords:** herbal medicines; phytotherapy; adipose tissue; weight loss.

## INTRODUCTION

The *Tynanthus fasciculatus* (Vell.) Miers is a liana from the Bignoniaceae family characterized by its woody vine stalk, small flowers, and dense inflorescences, described in great detail in the work of Medeiros and Lohmann (Medeiros and Lohmann 2015). It is popularly known as “cipó-cravo” for having an aroma similar to that of the clove (Carvalho et al. 2009).

This species occurs only in Brazil, mainly in the southeast region, in areas of humid forest, with few reports of populations in Cerrado areas (Cansian et al. 2015). *T. fasciculatus* is used in Brazilian traditional medicine in the form of tinctures, decoctions, or infusions as a sexual stimulant. It is also used in the treatment of digestive system diseases, such as gastritis and indigestion, diarrhea and parasitic control, and even the treatment of central nervous system conditions (Melo et al. 2010; Bolson et al. 2015; Cansian et al. 2015).

Studies have reported that *T. fasciculatus* extracts are rich in reducing sugars, coumarins, tannins, flavonoids, saponins, triterpenes, steroids (e.g., β-sitosterol-β-D-glucoside and stigmasterol), essential oils (e.g., eugenol), cardiotonic heterosides, and other phenolic compounds (Carvalho et al. 2009; Cansian et al. 2015). However, *T. fasciculatus* infusions are not able to extract tannins and essential oils, presenting all the other compounds reported.

A wide range of potential medicinal species has been explored for centuries by the traditional populations of Brazil, which is a country with one of the most diverse floras in the world (Brandão et al. 2013). However, much of this great medicinal potential remains untapped. Thus, there are still many

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species and substances that may be discovered, or even unreported effects of species already known. *T. fasciculatus* has several active compounds described that may allow a range of therapeutic effects in addition to those already known. In this work, we describe, for the first time, evidence of the potential anti-adiposity effect of the infusion of *T. fasciculatus* observed in Swiss mice treated with different dosages of its infusion.

## MATERIAL AND METHODS

The collection of *T. fasciculatus* was carried out in a forest remnant located in Viçosa, Minas Gerais, Brazil (20°46'29.2"S 42°52'24.1"W; h=600 to 800 m). The collected material was identified and authenticated in the Botanical Garden of the Federal University of Viçosa (UFV), where a core sample was deposited (No. 30,074). The stem was dried at 40 ºC and crushed in a grinding mill.

The infusion was prepared by mixing 100 g of the ground stem in 1 l of boiling water for 10 min, filtering on paper using a vacuum pump, and then being lyophilized. The final yield was 8.3 g (8.3%). The extract was resuspended in distilled water at the time of use.

Forty 90-day-old eutrophic male Swiss mice were randomly distributed in four experimental groups. Three groups were treated with 0.5 ml of infusion of *T. fasciculatus* in increasing dosages (100, 200, and 300 mg/kg/day) - Tf100, Tf200, and Tf300 - for 42 days by gavage. The dosages and experimental period were chosen based on a previous study (Melo et al. 2010). The control group (Control) received distilled water by gavage. The animals were kept under controlled temperature (22±2 ºC) and light in a 12-h light-dark cycle, with access to food and water *ad libitum*.

At the end of the experiment, the animals were fasted for 12 h, weighed, anesthetized with xylazine and ketamine (2 and 10 mg/kg, intraperitoneally, respectively), and euthanized by cardiac puncture exsanguination. The depots of epididymal white adipose tissue (eWAT) and interscapular brown adipose tissue (iBAT) were dissected, cleaned, and weighed. To calculate the adipose tissue depot relative weight, each weight of adipose tissue was divided by the bodyweight of each animal and multiplied by 100 (Melo et al. 2010).

The Animal Use Ethics Committee of the UFV approved the experimental protocol (No. 62/2014).

## RESULTS AND DISCUSSION

In this work, we describe, for the first time, the effects of the infusion of *T. fasciculatus*, known as "cipó-cravo", on the depots of eWAT and iBAT, as well as on the bodyweight of adult eutrophic male Swiss mice (Figure 1). All three doses tested were able to reduce the weight of the adipose tissue depots, thus reducing the adiposity of the animals, contributing to the reduction of bodyweight in the doses of 100 and 200 mg/kg. The 300 mg/kg dosage did not affect bodyweight.

Phytochemical agents are known for their ability to control bodyweight gain and the development of adiposity by various mechanisms. It has been reported that coumarins have proven effects on weight management (Sarker and Nahar 2020), leading to weight loss by regulating lipolysis, increasing thermogenic gene expression, suppressing adipogenesis, and reducing hyperlipidemia (Ko et al. 2018). A study with bergamottin, a coumarin present in grapefruit, showed a reduction of white adipose tissue (WAT) weight, preserving brown adipose tissue (BAT) weight, and additionally increasing the thermogenin (UCP1) expression, a mitochondrial uncoupling protein, in WAT and BAT (Ko et al. 2018). Also, coumarin derivatives may act as α-glucosidase inhibitors (Xu et al. 2020), assisting in glycemic control.

Thermogenesis can also be induced by polyphenols. Studies have shown that polyphenols, like catechins, can induce the expression of mitochondrial and signaling proteins related to thermogenesis (Sae-tan et al. 2015). These effects can lead to reduced adiposity and better management of bodyweight. However, thermogenesis activation may lead to increased BAT weight due to hypertrophy of brown adipocytes (Shabalina et al. 2013). In this sense, iBAT reduction by *T. fasciculatus* might be mainly related to other mechanisms. Together with polyphenols, such as saponins, also present in *T. fasciculatus* infusion, they can inhibit pancreatic lipase, consequently leading to reduced digestion and bioavailability of dietary lipids for absorption in the intestine (Subandi et al. 2019).

In addition, steroids present in *T. fasciculatus* infusion also act in metabolic pathways in order to enhance its effects. The stigmasterol may regulate insulin secretion, increasing its levels in the blood and also leading to decreased glycemic levels, thus assisting in bodyweight control (Panda et al. 2009). In another study, stigmasterol was shown to enhance glucose transporter 4 (GLUT4) translocation and expression in muscle tissue and WAT (Wang et al. 2017) allowing greater glucose transport to these tissues. β-sitosterol, another phytosterol, is also found in *T. fasciculatus* extracts and may help in hypercholesterolemia management and modulate the liver's lipid profile (Feng et al. 2018).

Taken together, the preliminary results of

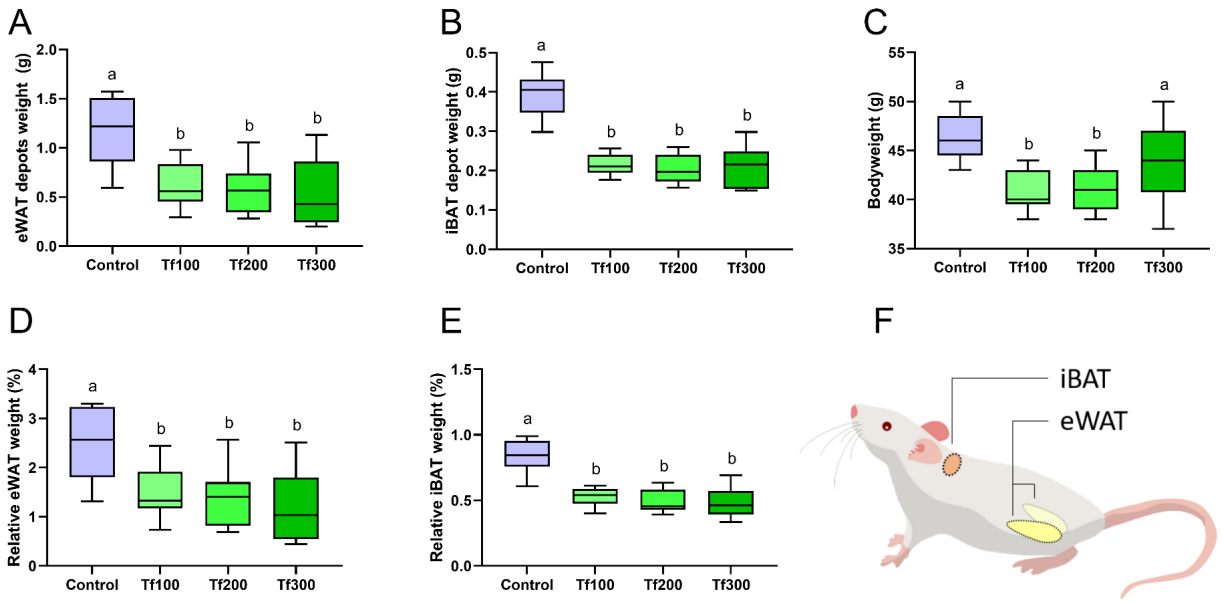


**Figure 1.** Effects of the infusion of *Tynanthus fasciculatus* in crescent dosages (100, 200, and 300 mg/kg – Tf100, Tf200 and Tf300 respectively) on the bodyweight, epididymal white adipose tissue (eWAT), and interscapular brown adipose tissue (iBAT) depots of adult male Swiss mice. **A** – eWAT depot weight. **B** – iBAT depot weight. **C** – Bodyweight. **D** – Relative eWAT weight. **E** – Relative iBAT weight. **F** – Representative illustration of the iBAT and eWAT depots anatomical location. Figure made with elements of freepik.com. The boxes represent the interquartile interval with the median indicated (horizontal line), and the whiskers represent the superior and inferior quartiles. Different letters above the bars indicate the statistical differences. The data were compared by one-way ANOVA followed by the Holm-Sidak *posthoc* test, considering statistical differences when $P \leq 0.05$ (n=10 animals/group).

this study show that the infusion of *T. fasciculatus* can be efficient in controlling weight gain in the 100 and 200 mg/kg doses and reducing adiposity in all three studied dosages. The exact composition of the plant's infusion should be further studied in order to identify molecules of therapeutic interest and elucidate mechanisms that led to the described effects. Having so many active compounds, the "cipó-cravo" represents a great pharmacological potential since it still has a lot of undescribed compounds and potential effects to be explored.


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## AUTHORS' CONTRIBUTION

Conceptualization: LCML, IRSCM, SLPM; Methodology: LCML, IRSCM, SLPM; Validation: LCML, JS; Formal analysis: LCML, EMD, JS; Investigation: LCML, EMD, JS; Resources: EMD, IRSCM, SLPM; Data Curation: LCML, ALABM; Visualization: LCML, EMD, ALABM; Writing - Original Draft: LCML; Writing - Review & Editing: LCML, EMD, ALABM, JS, IRSCM, SLPM; Project administration: IRSCM, SLPM; Funding acquisition: IRSCM, SLPM. All authors read and approved the final manuscript.

## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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