

Effects of *Trigonella foenum-graecum* L. and *Trigonella balansae* Boiss. & Reut on Gastric Hormones in Healthy Adults: An Exploratory Study

Supriya Bhalerao

Interactive Research School for Health Affairs (IRSHA), Bharati Vidyapeeth Deemed (to be) University, Pune

Poonam Gupte

Interactive Research School for Health Affairs (IRSHA), Bharati Vidyapeeth Deemed (to be) University, Pune

Shital Giramkar

Interactive Research School for Health Affairs

Asmita Wele

D Y Patil College of Ayurveda and Research Center

Rakhee Dangi

rakhee.dangi@bharatividyaapeeth.edu

Rajiv Gandhi Institute of Information Technology & Bio-Technology

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Abstract

Background

Fenugreek (*Trigonella* spp.) is traditionally used as an appetite stimulant and anti-diabetic herb. Modulation of gut hormones is one potential mechanism for its metabolic effects, but direct clinical evidence is limited.

Objective

To conduct an exploratory assessment of the short-term effects of two fenugreek species *T. foenum-graecum* and *T. balansae* on appetite, glucose levels, and selected gastric hormones in healthy adults.

Methods

Twenty healthy individuals (18–35 years) were randomized into three groups: *T. foenum-graecum* (FS1), *T. balansae* (FS2), or a combination (FS3). Participants received 2–3 g/day of the respective seed powders for 14 days. Outcomes assessed at baseline and day 15 included fasting and post-prandial glucose, acyl ghrelin, motilin, and GLP-1. Appetite was assessed using the Simplified Nutritional Appetite Questionnaire.

Results

Appetite improvement was reported by 4 participants in each group. Mean glucose values showed a mild reduction across groups but remained within normal limits. Acyl ghrelin showed a small, non-significant rise in FS1, while motilin exhibited minor changes without consistent trends. GLP-1 levels remained below detectable limits with the assay used. Adverse events were fewer in FS1 compared to FS2 and FS3.

Conclusion

Short-term administration of *T. foenum-graecum* was associated with improved subjective appetite and a mild decrease in glucose levels, though hormonal changes were minimal and non-significant. Given the very small sample size, these preliminary findings require cautious interpretation and validation in adequately powered clinical studies.

Introduction

Fenugreek (*Trigonella* spp.) is widely consumed in India as a food and traditional remedy.¹⁻² Experimental and clinical studies have reported its anti-diabetic, digestive, hypo-cholesterolemic and antioxidant effects, largely attributed to phytochemicals such as saponins, galactomannans, diosgenin and trigonelline.³⁻⁵ Emerging evidence suggests that gut hormones including acyl ghrelin, motilin and glucagon-like peptide-1 (GLP-1) play an important role in appetite regulation and glucose homeostasis.⁵⁻¹⁰ The influence of fenugreek on these gastric hormones in humans remains underexplored.

The genus *Trigonella* L. includes a number of medicinal and aromatic species commonly called as Fenugreek and widely used in traditional medicine¹. In India two species, namely, *T. foenum-graecum* L. (Fenugreek, methi) and *T. balansae* Boiss. and Reut (sickle fruit fenugreek, kasurimethi/ Champamethi /Marwari methi) are not only consumed as vegetables and spice but also used in management and treatment of diabetes¹⁰. Several beneficial physiological attributes of these *Trigonella* species regarding health have been reported in various *in vivo* as well as clinical studies over the past few decades. Antidiabetic, hypocholesterolemic, antioxidant, digestive stimulant, and hepatoprotective effect are some of the activities that have been proven for *T. foenum-graecum* L, attributable to its phytoconstituents. *T. balansae*, also termed as *T. corniculata* has been shown to possess anti- oxidant, anti- hyperglycemic, anti- cancerous, properties¹¹⁻¹³. Although both the species are used traditionally for digestion and metabolic health, comparative clinical data are lacking.

This exploratory study assessed short-term effects of these two species, individually and in combination, on gastric hormones, glucose levels and appetite in healthy adults. The findings were intended to generate preliminary data for future hypothesis-driven trials.

Materials and Methods

A randomized, open-label exploratory study was conducted after obtaining Institutional Ethics Committee approval (BVDUCOA/EC/750A/2023-24) and registration in Clinical Trial Registry of India (CTRI/2023/07/054751). Apparently healthy individuals (n = 24) of either sex in the age group 18–35 years were recruited. Those with known endocrine, gastrointestinal, hepatic, renal or psychiatric disorders, or those using supplements/herbal medications, were excluded.

Authenticated seeds of *T. foenum-graecum* and *T. balansae* were roasted, powdered, and encapsulated. The participants were randomly allocated to receive either of fenugreek variety or combination of both. The first group received capsules of *T. foenum-graecum* (FS 1), second group received capsules of *T. balansae* (FS 2) and the third group received capsules of both FS 1 & FS 2. The dose for FS 1 and FS 2 groups each, was 2000 mg/day- 2 capsules twice a day for 7 days followed by 3000 mg/day – 2 capsules thrice a day, for further 7 days, prior to meals, decided as per literature FS 3 group was given (FS 1) 1000mg/day + (FS 2) 1000mg/day (1 capsule from each species) twice a day for 7 days, followed by (FS 1) 1500 mg/day + (FS 2) 1500 mg/day thrice a day for further 7 days, before meals. The total treatment duration was 14 days and participants were instructed to avoid other medicines during this period.

The outcome variables were weight, blood sugar, gastric hormones- acyl ghrelin, motilin and Glucagon-like peptide 1 (GLP 1) done before and after the course of Fenugreek treatment. Other than weight, all the parameters were done in fasting as well as post prandial state *i.e.* 2 hours after breakfast. A Simplified nutritional appetite questionnaire¹⁴ (SNAQ) was administered to all participants for assessment of appetite, satiety, taste of food, number of meals along with assessment of bowel movements based on stool consistency and defecation ease. All parameters were done at baseline (day 0) and day 15, except SNAQ and bowel assessment which were additionally done on day 7 (telephonic follow up). Adverse events, if any, were noted at every follow up.

For estimation of hormones, the serum was separated from collected blood and stored in aliquots at -80°C in a deep freezer. Considering the biphasic secretion of GLP 1 as per literature, an additional blood sample (2 ml) was collected after 1 hour of having breakfast for its estimation. Commercially available ELISA kits purchased from Cloudclone Corp were used for hormone estimation.

Due to the limited sample size, results were summarised descriptively. Group comparisons used ANOVA or non-parametric equivalents with significance level at $p < 0.05$.

Results

Of the 80 approached and screened participants, 25 were found eligible and recruited. Twenty participants completed the study (FS1: $n = 6$, FS2: $n = 7$, FS3: $n = 7$). Baseline characteristics were comparable across groups.

A subjective increase in appetite (quantity of food intake) was reported by 4 individuals in each group. Minor improvements were noted in satiety and food taste, consistent with the traditional digestive-stimulant use of fenugreek. Bowel ease improved mainly in the FS3 group.

A mild reduction in fasting and post-prandial glucose was observed in all groups, though values remained within physiological norms. Given the healthy status of the study participants, these findings need additional investigations.

In case of fasting median levels of Acyl Ghrelin, FS1 group showed a mild increase on day 15 as compared to day 0 levels. Not much difference was observed in FS 2 group, while FS 3 group demonstrated a marginal decrease. The post-prandial median Acyl Ghrelin levels were found increased in FS1 and FS3 groups on day 15 compared to day 0, whereas no such increase was noted in FS2 group. On day 0, the post-prandial median Acyl Ghrelin levels were lower than fasting levels. The same trend was seen on day 15 in FS2 group. Contrary to this, FS1 and FS3 groups showed increase in the post-prandial levels compared to fasting levels. This increase was more pronounced in FS3 group. There was no significant difference within or among the groups (Table 1).

Table 1
Effect of Fenugreek on Acyl Ghrelin

Acyl Ghrelin (pg/ml)		Fasting	Post Prandial
All groups	Day 0	34 (11.7–59.6)	29.5 (9.8–52.5)
FS 1	Day 15	41.8 (24.5–56.7)	44.2 (29.2–56.2)
FS 2		35.4 (14.1–51.5)	30.2 (8.9–49.1)
FS 3		31.6 (11.7–63.8)	45.3 (22.6–51.5)
Data expressed as Median (Range)			

In the fasting state, there was slight reduction in median levels of Motilin on day 15 in FS1 and FS2 groups compared to day 0 levels while a little increase was seen in the FS3 group. The same trend was seen in the post-prandial levels. The post-prandial levels of motilin were lower than the fasting levels at baseline and even after treatment. No significant difference was seen within and among groups (Table 2).

Table 2
Effect of Fenugreek on Motilin

Motilin (pg/ml)		Fasting	Post Prandial
All groups	Day 0	75.34 ± 4.6	74.16 ± 5.3
FS 1	Day 15	73.66 ± 6.55	71.67 ± 7.16
FS 2		74.13 ± 2.61	73.54 ± 4.70
FS 3		78 ± 3.23	76.91 ± 2.92
Data expressed as Mean ± SD			

The GLP-1 levels were found below detection limits in all the groups at all-time points.

Discussion:

The lack of marked hormonal response may reflect the inclusion of normoglycemic, asymptomatic individuals and the short treatment duration. Previous studies have shown that modulatory effects on motilin and GLP-1 are more evident in individuals with gastric dysmotility or diabetes.^{14,15}

Only one participant from the FS1 group noted heat sensation and acidity during the study. Of the other two groups, five participants from the FS2 group suffered from either heat sensation, burning pain in chest, headache or black outs during the study.^{16,17} These findings support wider traditional culinary use of FS1 (*T. foenum-graecum*).

Overall, the findings suggest that in healthy individuals, *T. foenum-graecum* modestly influenced appetite and glucose trends^{18, 19} compared to *T. corniculata*, but definitive conclusions regarding gut hormone modulation cannot be made.

Conclusion

In this exploratory study, *T. foenum-graecum* demonstrated better tolerability and a mild, non-significant trend toward improved appetite and reduced glucose levels in healthy individuals. Changes in gastric hormones were minimal in all groups. These preliminary observations highlight the need for larger, controlled studies including populations with metabolic dysregulation to clarify the mechanistic role of fenugreek species in gut-hormone mediated metabolic effects.

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