

# Karela

*Momordica charantia* L. (Cucurbitaceae)

## Synonym(s) and related species

Balsam pear, Bitter cucumber, Bitter gourd, Bitter melon, Cundeamor, Ku gua.

## Constituents

The active constituents of the fruits are **triterpenes** including momordicin and momordicinin, and a series of cucurbitanes, momordicosides, goyaglycosides and kuguacins; **proteins** including  $\alpha$ ,  $\beta$  and  $\gamma$ -momorcharins, and momordins a and b and **polypeptide P**, also known as vegetable or plant insulin (v- or p-insulin). **Pyrimidines** such as such as vicine and charine are found particularly in the seed, and many sterols (including charantin), fatty acids and volatile compounds have also been identified in the fruit. The chemical composition of the leaf is less well-known, but it does contain goyasaponins.

## Use and indications

The fruits of karela are eaten all over the world, as a food as well as for their medicinal properties. The leaves are occasionally consumed as 'bush tea'. Most commonly karela has been used for the treatment of type 2 diabetes. Despite well-documented hypoglycaemic effects, a Cochrane review has concluded that the evidence is conflicting and issues of standardisation must be addressed before it can be recommended for clinical use.<sup>1</sup> Other traditional uses include the treatment of gastrointestinal cramps, cancer, viral infections, and immune disorders. Karela is contraindicated in pregnant

women as it can induce abortion in animals. Hepatotoxicity has been reported in animal studies and ingestion of vicine (from the seed) may cause favism (an acute haemolytic crisis in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency often seen in response to broad beans).

## Pharmacokinetics

In an *in vitro* study, an aqueous extract of karela leaves inhibited the 4-hydroxylation of diclofenac by CYP2C9.<sup>2</sup> In another *in vitro* study, an alcoholic extract of karela was found to inhibit P-glycoprotein activity.<sup>3</sup> Whether these effects are clinically relevant is unclear.

## Interactions overview

Karela appears to have blood glucose-lowering effects and can potentiate the effects of chlorpropamide and other antidiabetics.

## Interactions monographs

- Antidiabetics, page 314
- Food, page 314
- Herbal medicines, page 314

1. Ooi CP, Yassin Z, Hamid TA. *Momordica charantia* for type 2 diabetes mellitus ().
2. Appiah-Opong R, Commandeur JNM, Axson C, Vermeulen NPE. Interactions between cytochromes P450, glutathione S-transferases and Ghanaian medicinal plants. *Food Chem Toxicol* (2008) 46, 3598–3603.
3. Konishi T, Satsu H, Hatsugai Y, Aizawa K, Inakuma T, Nagata S, Sakuda S, Nagasawa H, Shimizu M. Inhibitory effect of a bitter melon extract on the P-glycoprotein activity in intestinal Caco-2 cells. *Br J Pharmacol* (2004) 143, 379–87.

## Karela + Antidiabetics



The blood glucose-lowering effects of chlorpropamide and other antidiabetics can be increased by karela.

### Clinical evidence

A report of a patient whose diabetes was poorly controlled on diet and **chlorpropamide**, but much better controlled when she ate curry containing karela, provides some evidence that the blood glucose-lowering effects of karela and conventional oral antidiabetics can be additive.<sup>1</sup> Small, non-controlled studies have subsequently shown that karela produces a significant improvement in glucose tolerance in patients with type 2 diabetes, both when they are taking **chlorpropamide**,<sup>2</sup> **tolbutamide**,<sup>2</sup> **glibenclamide**,<sup>2,3</sup> **glymidine**<sup>2</sup> or **metformin**,<sup>3</sup> and when they are not taking antidiabetics.<sup>4–6</sup> In these studies, karela was given orally as a juice from the fruit,<sup>2,4</sup> dried powdered fruit,<sup>5,6</sup> fried fruits,<sup>2</sup> aqueous extract,<sup>6</sup> or solvent extract from the fruit.<sup>3</sup>

However, in a small, randomised, placebo-controlled study in 40 patients with type 2 diabetes given karela capsules (*Charantia*) three times daily after meals for 3 months, both karela and placebo had no statistically significant effect on HbA1c (there was a very slight increase of 0.28% and 0.5%, respectively) and there was no change in fasting blood glucose (slight decrease with karela and an increase with placebo). In this study, karela was taken in addition to standard **oral antidiabetics** (types not stated) and patients included both those newly diagnosed and those with established diabetes, with HbA1c levels of 7 to 9%.<sup>7</sup>

A case report describes hypoglycaemic coma and seizures in two young non-diabetic children after they were given karela tea.<sup>8</sup>

### Experimental evidence

In a study in *rats*, the combination of an alcoholic extract of karela with rosiglitazone 2 mg/kg or 5 mg/kg caused a greater reduction in serum glucose levels than either dose of rosiglitazone alone, in both an oral glucose tolerance test and streptozotocin-induced diabetes. In addition, the combination of karela extract with low-dose rosiglitazone had an effect on serum glucose concentrations similar to that seen with high-dose of rosiglitazone alone.<sup>9</sup>

### Mechanism

The blood glucose-lowering effects of karela may be due to the constituent polypeptide P<sup>10</sup> (see under constituents, page 313) This substance is effective when given subcutaneously,<sup>11</sup> but its oral activity is uncertain.<sup>12</sup> Other constituents with blood glucose-lowering

effects include charantin and vicine. Karela may have both insulin-like effects and stimulate insulin secretion.<sup>12</sup>

### Importance and management

The blood glucose-lowering activity of karela appears to be established, although the best controlled clinical study so far found its effects to be minimal. Health professionals should therefore be aware that patients may possibly be using karela as well as more conventional drugs to control their diabetes. Irregular consumption of karela as part of the diet could possibly contribute to unexplained fluctuations in diabetic control.

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## Karela + Food

No interactions found.

## Karela + Herbal medicines

No interactions found.