RESEARCH SUMMARY

The science of Amarasate®

Plant & Food Research, Auckland, New Zealand

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Amarasate® is a natural extract of New Zealand hops that has been clinically demonstrated to regulate eating behaviour. An early stage clinical trial suggests that taking Amarasate® before a meal can reduce the amount of food eaten and therefore reduce calorie intake, via a mechanism termed the “bitter brake”.

Sensing food in the gastrointestinal tract

The gastrointestinal tract contains a large number of receptors (chemical sensors) that detect and relay to the body the composition and location of foods been digested and absorbed[1][2]. These chemosensory receptors include receptors for specific nutrients as well as classical taste receptors responsible for detection of sweet, savoury, sour, salty and bitter tastes. Specialised cells in the gut that express these receptors release more than 30 different gut hormones and other signalling chemicals when activated that regulate short-term eating behaviour, gut function (motility/secretion) and the metabolism and storage of nutrients by the body[3]. These hormonal signals also play a critical role in regulating the brain’s appetite control centres, providing a powerful “stop eating” (satiation) and “I’m full” (satiety) message[4].

Sensing bitter compounds

Bitter compounds have long been thought to have appetite control properties, with both stimulation and suppression effects reported[5]. There is considerable research suggesting that bitter taste receptors in the gastrointestinal tract may play a part in regulating appetite through hormone signalling pathways[6][7][8][9][10], even when those bitter compounds are not tasted on the tongue[11]. Preclinical research suggests that the delivery of bitter compounds to an area of the gastrointestinal tract known as the duodenum, just below the stomach, may trigger the signals that suppress appetite[12]. This has been demonstrated with known bitter compounds, such as denatonium (marketed

[1] Reimann et al. 2012 https://www.sciencedirect.com/science/article/pii/S1550413112000198
[2] van der Wielen et al. 2014 https://doi.org/10.1371/journal.pone.0107531
[3] Lean & Malkova 2015 https://www.nature.com/articles/ijo2015220
[4] Gao & Horvath 2007 https://www.annualreviews.org/doi/abs/10.1146/annurev.neuro.30.051606.094324
[5] Janssen et al. 2011 http://www.pnas.org/content/108/5/2094
[6] Rozengurt & Sternini 2007 https://www.sciencedirect.com/science/article/pii/S1471489207001737
[7] Sternini 2007 https://www.physiology.org/doi/10.1152/ajpgi.00411.2006
[8] Sternini et al. 2008 https://journals.lww.com/co-endocrinology/Abstract/2008/02000/Enteroendocrine_cells__a_site_of__taste__in.11.aspx
[9] Chen et al 2006 https://www.physiology.org/doi/abs/10.1152/ajpcell.00003.2006
[10] Schier et al. 2011 https://www.physiology.org/doi/10.1152/ajpregu.00344.2011
[11] Janssen et al. 2011 http://www.pnas.org/content/108/5/2094
[12] van Avesaat et al. 2015 https://academic.oup.com/ajcn/article/102/4/729/4564673

as Bitterant-b, Bitter+Plus and others) [13], quinine[14] and an extract from the Bushman's hat, *Hoodia gordonii*[15]

Bitter is linked to eating behaviour

Scientists at Plant & Food Research proposed that extracts from plant-based foods targeting gastrointestinal receptors that trigger the hormones that control appetite may improve people's ability to stick to reduced energy diets by reducing hunger signals, ultimately helping them meet their weight-loss goals. More than 900 plant extracts were screened for their ability to trigger signalling pathways in a lab-based model, particularly the hormone CCK from cells mainly found in the duodenum, a response we termed the "bitter brake". One extract, from a specific variety of New Zealand hops, generated a much greater response than other extracts. This extract was named Amarasate®.

Amarasate® modifies eating behaviour

The Amarasate® extract was tested in a human clinical trial with 20 healthy men. The study involved a randomized, double-blind, placebo-controlled cross-over study (a study where neither participants nor researchers knew what capsules were taken, and each participant took each of the capsules one week apart). Participants' food intake was measured after taking the Amarasate® extract delivered in a capsule that opened in the stomach or in the duodenum, or a placebo. The study showed that when Amarasate® was delivered to the duodenum, participants ate, on average, 944kJ (226 calories) less than with placebo over 3.5 hours, approximately an 18% reduction in energy intake[16].

A second clinical trial has been conducted, studying the effects of Amarasate® on overweight or obese women. Results of this trial are expected in the second half of 2018.

[13] Avau et al. 2015 https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145538
[14] Andreozzi et al. 2015 http://www.jnmjournal.org/journal/view.html?doi=10.5056/jnm15028
[15] Le Neve et al. 2010 https://www.physiology.org/doi/10.1152/ajpgi.00135.2010
[16]Ingram et al 2016 https://doi.org/10.1159/000446744