



# FOOD FILES

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## How carbs, fats, and taste affect how much we like and want food – not calories or processing

Processed foods that are hyperpalatable or energy dense are often assumed to contribute to weight gain due to excessive consumption - they taste so good that we cannot stop eating them.

However, this is not well established in science. Not all processed foods have the same composition and there are many other factors beyond 'liking' that affect how much we eat. A recent study explored factors influencing how much we like food and how it contributes to food reward. They focused on three main factors: energy density, level of processing (according to the NOVA classification system), and the carbohydrate-to-fat (CF) ratio. A range of processed foods were rated by 224 adults on how much they liked them (liking), how much they wanted to eat them (reward) and their imagined taste intensity.

Contrary to expectations, there was no relationship between liking and reward with the energy density

of foods or how processed they were. However, foods that had a balanced CF ratio and a stronger taste intensity tended to be liked more and had a greater perceived reward. Also, foods with greater fibre content tended to be liked less. CF ratio, taste intensity and fibre content were the greatest determinants of liking and food reward, independent of energy density and processing.

The researchers theorise that liking and reward are primarily determined by how much energy a food contains versus how filling that food is, which they call energy-to-satiety ratio (ESR). For example, processed foods that are high in fat and sugar (eg. cakes and potato chips) have a high ESR, while foods with a high fibre content (eg. snack bars and breakfast cereals) have a low ESR. Both are highly processed but have a different effect on eating behaviour.

The ESR of a food may therefore be a better metric used in the future to understand the intake of processed foods.

Rogers PJ *et al.* Evidence that carbohydrate-to-fat ratio and taste, but not energy density or NOVA level of processing, are determinants of food liking and food reward. *Appetite*. 2024; 193:107124.

## Unlocking the mystery: how peracetic acid in orange juice creates a clove symphony

Orange juice is a popular and widely consumed beverage. While freshly squeezed juice is revered as the pinnacle, the significance of industrially processed juice is on the rise.

Whether derived from concentrate or not from concentrate, most industrially processed orange juice undergoes thermal pasteurisation to prolong shelf life at room temperature. A primary driver of orange juice's appeal lies in its delightful aroma. Extensive research has delved into the compounds contributing to its characteristic aroma, as well as those responsible for certain common off-flavours linked to processing and storage.

The primary aroma compounds found in freshly hand-squeezed orange juice encompass ethyl (2S)-2-methylbutanoate (fruity), ethyl butanoate (fruity), (3Z)-hex-3-enal (green, grassy), ethyl 2-methylpropanoate (fruity), acetaldehyde (fresh), and (R)-limonene (citrus-like) among others. However, thermal processing can

trigger the generation of undesirable compounds such as dimethyl sulfide with a cabbage-like odour, originating from (S)-methylmethionine. Additionally, during storage, the acid-catalysed process leads to the formation of  $\alpha$ -terpineol, imparting a turpentine-like smell.

Limonene and linalool are both present in substantial amounts in orange juice, contributing to this transformation. Nonetheless, the most significant off-flavour compound in orange juice is 2-methoxy-4-vinylphenol, commonly known as 4-vinylguaiacol (4-VG). This compound produces a clove-like aroma and significantly influences the distinctive aged-type off-flavour observed in stored orange juices.

An investigation by Bauersachs *et al.* utilised gas chromatography-olfactometry and aroma extract dilution analysis on an orange juice exhibiting a distinct clove-like off-flavour, leading to the identification of 5-vinylguaiacol (5-VG). This compound shared the same odour profile as 4-VG but had not previously been detected in orange juice. In five out of six commercial orange juices displaying clove-like off-flavours, 5-VG exhibited even greater odour potency than 4-VG. Additionally, through spiking and model studies, residues of peracetic acid were identified, a cleaning agent used during orange juice processing.

This compound can undergo Baeyer-Villiger oxidation with the natural orange juice compound, hesperidin during subsequent heating (eg. pasteurisation), resulting in the generation of significant amounts of 5-VG. 5-vinylguaiacol can play a pivotal role in the production of off-flavours, contributing substantially to the clove-like character compared to the well-established orange juice off-flavour compound 4-VG. It was recommended by the authors that the use of peracetic acid in orange juice processing facilities should be discontinued.

Bauersachs E, Walsler V, Reglitz K, Dawid C and Steinhaus M (2024) Peracetic acid residues in orange juice can lead to a 5-vinylguaiacol-induced clove-like off-flavor via Baeyer-Villiger oxidation of hesperidin. *Food Chemistry*. 440: Article 138252.



### That ad(d)s to my appetite

Do you feel hungrier or crave certain foods after seeing food ads? You're not alone. A new study by Boyland and colleagues of the University of Liverpool has found that food ads can make us hungrier and crave more food, especially the foods that are shown in the ads. The study used a smartphone app to measure how adults felt after seeing food ads on TV, online, or outdoors.

The study involved 54 participants (mostly women, average age 21) who provided ratings of their hunger and cravings for different types of food (such as fast food, soft drinks, snacks, etc.) up to six times per day when they saw a food ad and at random times. The study lasted for one week and collected 1,223 assessments.

The results showed that people felt hungrier and craved more food after seeing food ads than at random times. This effect was stronger for TV ads than for online or outdoor ads. People mostly craved the types of food that were advertised, such as pizza or chocolate.

The study used a method called Ecological Momentary Assessment (EMA), which allows researchers to

capture real-time data on people's feelings and behaviours in their natural environments. EMA can be effective for assessing how food marketing influences our appetite and food choices.

The study provides evidence that food marketing is associated with hunger and craving in adults, which may have implications for public health and obesity prevention. The study suggests that policymakers should consider regulating food advertising to protect consumers from its harmful effects.

Boyland E, Spanakis P, O'Reilly C, Christiansen P. Associations between everyday exposure to food marketing and hunger and food craving in adults: An ecological momentary assessment study. *Appetite*, Volume 196, 2024. <https://doi.org/10.1016/j.appet.2024.107241>.

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