

Naturals in food: facts, myths, perceptions

In the first of a two-part article, scientists *Martin Rose, Taichi Inui, Moira Dean* and *Jane Parker* examine the true meaning of the term 'natural' within the food sector, and examines whether or not it's always a safer, more nutritious choice.

AS CONSUMERS, we expect and demand that the food we consume should be safe and of good quality, but our perception of 'safe' and 'quality' is personal, and constantly evolving. Increasingly, the consumer is seeking organic produce, fewer

food ingredients and additives (particularly in Europe with the removal of E numbers), proof of authenticity and provenance and, in particular, natural and sustainable ingredients. But what does 'natural' mean, and is 'natural' always better; ie, safer, more wholesome and more nutritious?

Are there times when transparency is compromised in order to be able to describe food as natural?

What is a 'natural' ingredient?

The term 'natural' is defined as "existing in or derived from nature; not made or caused by humankind", or "having had a minimum of processing or preservative treatment". An image is conjured up in the mind of the consumer of green fields, the open rural environment, and often a sense of healthier and perhaps safer products.

The term 'synthetic', on the other hand, is defined as "made by chemical synthesis, to imitate a natural product" or "not genuine; insincere", and conjures up images of industrial chemical synthesis in an urban environment and an inferior product.

The distinction between these may be clear in the mind of the consumer, and is clear in terms of chemistry when considering clothing materials, for example, where natural (cotton) and synthetic (nylon) are quite distinctly different in their chemical make-up. However, the distinction is blurred when it comes to food, as in many cases the natural and the synthetic versions are identical chemically. In terms of risk, if the molecules are identical, neither the method of production, nor the origin are relevant. But even the consumer perception of 'natural' does not always mean safe; most recognise that some fungi can be dangerous, and are also aware of headlines such as "Two-star Michelin restaurant chef suspended over puffer fish poisoning"¹. It is clear that the definition of 'natural' depends on your viewpoint – whether as consumers, as food regulators or as food chemists.

Consumer perception and consumer choice – heuristics

So how does the consumer develop their perception of natural, and how does this influence their purchase intent? All consumers (including regulators and food chemists) use heuristics to select at least some of their grocery products. The term heuristic refers to any approach to problem solving, learning, or discovery that employs a practical method, not guaranteed to be optimal, perfect, logical, or rational, but instead sufficient for reaching an immediate goal. Heuristics can be mental shortcuts that ease

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the cognitive load of making a decision. During food selection, for example in a supermarket, choice is not always based on logical or scientific reasoning. Rarely is there time to read every ingredient and make an analysis of whether or not purchases planned will result in a well-balanced, nutritious diet. Instead, the consumer is guided heuristically by food packaging, appearance such as colour, and simple terms that may be written on the packaging such as 'wholesome', 'nutritious', 'fresh' and 'natural'. But what do these terms actually mean?

The term 'natural' is variously used and misused by sections of the food industry on labels and in advertisements. In a survey conducted in the USA², consumers were asked which of a list of foods and ingredients were 'natural'. More than 60 per cent answered that corn and soya bean were natural, even though in the USA 92 percent and 94 percent of these products are genetically modified! Different flours (pea, wheat, sorghum) gave rise to different responses, possibly due to lack of familiarity. Products described by their chemical names were generally not considered natural, even when derived from natural sources.

In contrast to the situation in Europe, the term 'natural' has no legal definition within the USA so consumers from the EU and the USA have a different perception of the term 'natural'. These different perspectives were discussed by Rosin *et al* (2012)³. In the USA, the most frequent definition of natural⁴

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BELOW: Vanillin that has been synthesised from petrochemical precursors needs to be labelled differently to the identical molecule that has been extracted from *Vanilla planifolia*



RIGHT: Puffer fish may be a natural product – but that certainly doesn't mean they're always good for you; sometimes they can be poisonous.



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was “no additives” whereas in Europe it was “lack of processing”. Interestingly, “origin in nature” was only used by about one third of respondents, although in France and the UK, this figure was much lower.

‘Natural’ food choices are generally important for consumers, although there are differences associated with country, gender and age of the consumer⁴. Many characteristics contribute to the concept of ‘natural’ and these can be assigned to six basic groups: psychological factors; situational factors; socio-cultural factors; extrinsic product characteristics; intrinsic product characteristics; and biological and physiological factors. Consumer beliefs also play a role, such as a belief that ‘wild types are more natural and better than varieties with genetic modifications’; or a belief that ‘natural foods

have superior sensory characteristics such as taste, or possess higher nutritive value’. These beliefs can be classed in two categories: 1. ideational beliefs, which are that natural entities are morally and/or aesthetically superior as they represent the original state, or are untouched by human intervention and 2. instrumental beliefs, which are to do with functional or material superiority⁵.

There is an underlying conflict in consumer preferences. Heuristics may lead to biased decisions: people may assume that they need to be less concerned about natural hazards than human-made hazards, or they may consider natural to be healthier when compared with synthetic product. They may view the qualitative characteristics of a hazard, rather than the relevant quantitative information. In general, the wish for unprocessed and natural foods needs to be balanced against the desire for foods with long shelf-lives that are convenient and quick to cook, and often these are incompatible.

Regulations

The regulatory bodies exist for the benefit of the consumer, to ensure that what is sold to the consumer is fit for purpose, which, in terms of food, requires it to be healthy, safe and nutritious. Another important aspect of food regulation is ensuring that food products are not portrayed in any way that might mislead the consumer. However, trying to harmonise the heuristics of the consumer with the logical approach of the scientist is a challenge for the regulatory bodies, and consequently food regulations do not always make sense. For example, there is a difference between a food colour and a colouring food. Food colours are regulated, whereas colouring foods are not, yet many are the same thing!



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RIGHT: In October 2018, the FDA announced that it was removing the ‘natural’ component of peppermint from the list of approved flavourings on the grounds that it is reported to be a carcinogen

The flavouring regulations pose some interesting dichotomies. In the EU, flavourings are the subject of Regulation 1334/2008. Within these regulations, there are three guiding principles around the term ‘natural’. These are that the origin of the source material must be natural, the flavouring substance must have been identified in nature and the material should be produced by ‘traditional food preparation processes’ as listed in Annex II of the regulation. Furthermore, these substances must meet the criteria that 1. they do not pose a safety risk to the consumer, and 2. their use does not mislead the consumer. At first glance, this seems entirely reasonable, but as is often the case with regulations, there are grey areas and anomalies. Firstly, note that the category of ‘artificial’ was not included in this regulation, so any claim in the EU for “no artificial flavours” is meaningless and illegal. Within the US, there are different definitions and natural flavourings must be derived from natural starting materials, and must also be listed as Generally Recognised As Safe (GRAS). **Table 1** shows just how diverse the flavour regulations are in the EU compared to the US. The US Food and Drug Administration (FDA) discourages the food industry from using the word ‘natural’ on labels because of its ambiguity. It accepts that it is a very complex term and have purposely decided not to define it on the grounds that, natural’ may unjustifiably imply that a food is of superior quality or safety compared to other similar foods⁶. In October 2018, the FDA announced that it was removing two ‘natural’ components of peppermint and sage (pulegone and thujone) from the list of approved flavourings, on the grounds that they are reported to be carcinogens, thus demonstrating their point that natural does not equal safe.

However, looking at vanillin we see the reverse, where vanillin which has been synthesised from petrochemical precursors (guaiacol and glyoxylic acid) needs to be labelled differently to the identical molecule that has been extracted from

Vanilla planifolia. The legislation provides a clear distinction for consumers, although as chemists we see the same chemical just obtained from a different source (also see Part 2 in the next issue of *New Food* about ‘natural’ vanilla derived from non-vanilla sources). However, one key difference is that a compound from a synthetic source has undergone strict *in vitro* and *in vivo* toxicity tests, as required by EFSA, in order to be classed as flavouring substances. Another example would be that of smoke. Natural smoke contains polyaromatic hydrocarbons, which are known carcinogens, whereas these carcinogens can be removed (or omitted) from smoke flavourings. However, smoke flavourings cannot be labelled as natural. **■**

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In the next of *New Food*, we'll be looking at risk assessment, and drivers and challenges in relation to 'natural' products and ingredients.

TABLE 1 Natural status of flavour categories in the EU and the USA

Flavour category	EU	USA/ROW
Flavouring substances	Can be natural	Can be natural
Flavouring preparations	Are natural	Are natural
Thermal process Flavourings	Can't be natural	Can be natural
Flavour Precursors	Can't be natural	Can be natural
Smoke flavourings	Can't be natural	Can be natural
Other flavourings	Can't be natural	Can be natural

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PROFESSOR MOIRA DEAN'S research group focuses on studying the ‘head, heart and hands’ (perceptions, attitudes, and behaviours) of actors along the food supply chain to explore food security challenges in three main areas: (1) global food integrity, (2) nutrition and health, and (3) how we'll feed the world's growing population in a sustainable, cost-effective and environmentally friendly way

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