



Issue 11: June, 2021: This e-bulletin is aimed at health professionals, consumers, growers, farmers, packers, processors, distributors, retailers, and others in the plant foods area.

Plant-based meat alternatives: - will they go mainstream?

Developments in plant-based meat alternatives ('meatless meats') are outlined in terms of drivers involved, protein sources, ingredients/formulation, developing texture/flavour, and consumer acceptance. The European plant-based market is expected to grow to €18.3bn by 2023 (Kerry 2020). This represents an opportunity for SMEs to engage in plant-based meats and also for large companies, either on their own, or via take-overs of successful SMEs.

Drivers of plant-based meat product development

Today's consumers are concerned with global warming, animal welfare and eating healthily. Meat production is a major contributor to greenhouse gases but producing an equivalent amount of isolated soy protein has a much lower carbon footprint and hence its use as a protein source in plant-based meat products (DuPont, 2018). Animal welfare issues such as (i) animals housed in close proximity to each other causing stress; (ii) alterations such as tail docking and beak-trimming, and (iii) slaughtering animals young to ensure flavour and tenderness are all concerns. The third driver is health issues. While meat is a good source of key nutrients, it also has negative health connotations in consumers' minds regarding saturated fat and cholesterol content and the link to inflammatory diseases. Heterocyclic amines (HCAs) produced during cooking of meat at high temperatures for long periods are a concern (induce tumour development in animal models) as are reactive oxygen species that may be formed during processing/cooking. These drivers are leading to more flexitarian/vegetarian eating with plant-based meats providing a new option.

Protein sources/ingredients/formulation

A major challenge in developing plant-based meat products is achieving a protein quality equivalent to that of meat. Soy is considered a complete protein and textured soy protein, an extruded product, is the protein source of choice in many plant-based meats due to its nutritive value and good functional properties. However, soya is also a food allergen and should be declared as such. Pea protein isolates are non-allergenic and are also used as meat replacers. Pea protein has adequate functional properties and its oil holding capacity can improve flavour retention and product mouthfeel. Gluten is used to make seitan which has a meat-like texture but does not taste like meat. However, boiling the gluten mass in a savoury solution imparts flavour resulting in a textured shredded meat-like material (Anwar & El-Chaghaby, 2019). Rice protein isolate is hypoallergenic and is used in plant-based meats either on its own or in combination with other plant-based proteins. Other protein sources with potential for inclusion in plant-based meats include algae, peanut protein concentrate, rapeseed meal, quinoa and potato protein (Jiménez Munoz *et al.*, 2021).

Generating flavour and texture in plant-based meats

Sensory acceptance of plant-based meat products is of key importance. Hydrolysed vegetable proteins (HVPs) from soy, corn or wheat are the primary forms of protein

present in plant-based meats. HVP is high in free amino acids and peptides which enhance flavour thus improving the perceived taste of the product (Jeon *et al.*, 2020). Yeast extracts are also used as they have sulphur-containing volatiles, which impart a meaty aroma following thermal treatment. Spices such as red, white and black pepper, mustard, garlic, allspice and cinnamon are used extensively in plant-based meat products to impart/enhance or mask flavours but also because of their nutritional, antioxidant, anti-inflammatory and antimicrobial properties. Plant-based meat products can be divided into those mimicking comminuted or ground meat products (e.g. burgers) and those which mimic whole muscle meat. Extrusion is the most common method used to generate texture in plant-based meats. The pressure, heat and eventual pressure release in the extruder cooks the food mix and results in an expanded product. Low moisture or dry extrusion is used for burger type plant-based meat products as it results in a denser protein pellet with a fibrous texture. This is then moulded into a patty or sausage. Whole muscle meat alternatives are produced using high moisture or wet extrusion, resulting in a fibrous chunk of plant protein (usually soya), similar to that of real meat. Soya is often supplemented with other forms such as pea protein or gluten to add additional nutritional and physical properties, e.g. gluten on heating coagulates to form a moist, resilient gel which makes it an ideal 'partner' ingredient in the production of plant-based chicken and meat. Extrusion enhances juiciness, tenderness, colour (via Maillard reaction & caramelisation), protein availability and protein digestibility of the extrudate. Hydrocolloids such as carrageenan from red algae improve firmness and the development of fibres. Other thickening agents may be used, e.g. tomato pomace. It contains high levels of pectin and improves hardness/cohesiveness and moisture retention in meat-free sausages.

Conclusions: Appearance, flavour and texture attributes of plant-based meats are key to consumer acceptance. Consumers are concerned about the range of ingredients/additives in plant-based meats. However, real meat products and sausages also have a range of ingredients/additives. Campaigns to promote plant-based diets include 'Veganuary' (vegan diet for January), and 'Meatless Monday' (no animal meats on Monday each week). Currently, plant-based meat products are usually more expensive than their real meat counterparts. However, rising costs of real meats may offset the differential. Research on the safety of plant-based meat products is limited as it is a new area but the ingredients/additives used are "Generally Recognised as Safe" (GRAS status). Shelf life of plant-based meats is generally longer than their real meat counterparts as ingredients are usually less microbiologically sensitive. While plant-based meats will command an increasing market share (at least in the medium term), beef, pork, lamb and chicken will continue to hold centre stage for flavour, texture and perceived naturalness.

References

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