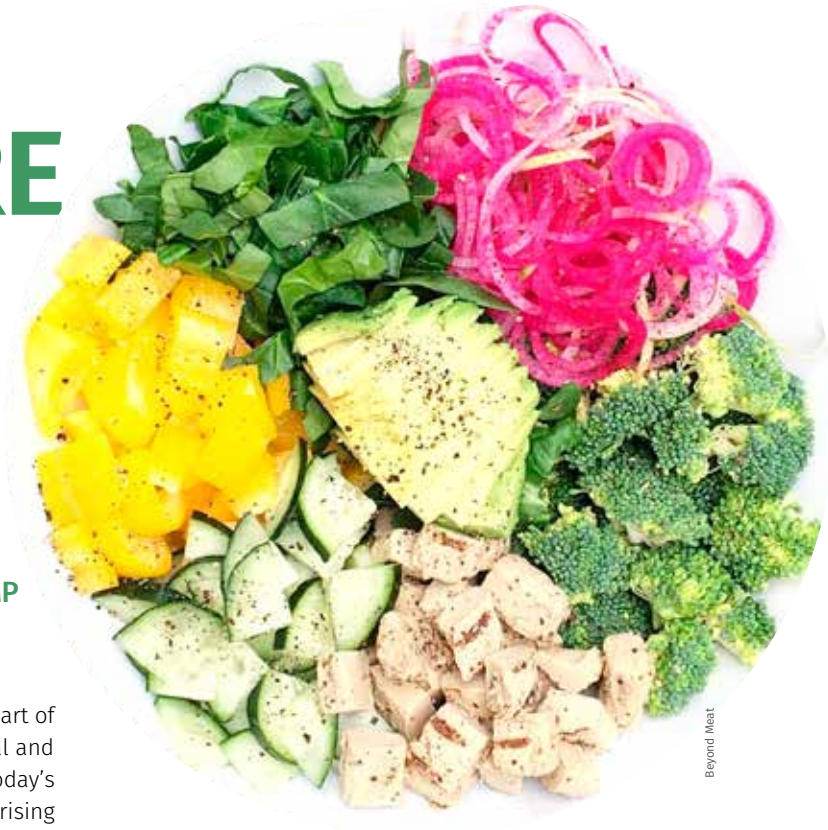
PLANTS— THE FUTURE OF MEAT

THE PAST IS OUR GUIDE, BUT IT NEED NOT DICTATE TOMORROW. A REAL REVOLUTION IS UNFOLDING IN THE FOOD WORLD RESULTING IN MEAT ANALOGS THAT TASTE LIKE THE REAL THING. THE ONLY CATCH? IT IS MADE PURELY OF PLANT PROTEIN, BUT THAT SEEMS TO BE THE FUTURE OF MEAT. BY **HENK HOOGENKAMP**



Beyond Meat

HUMANS have long consumed meat; it is a necessary part of our diet due to the protein it contains, and even a vital and essential part to some. That said, more and more of today's consumers are falling off the 'meat' wagon due to the rising health and wellness trend where meat—particularly red meat—is perceived as unhealthy. These consumers who are boosting the vegan and flexitarian populations are driving the demand for meat and protein alternatives, leading manufacturers to search for newer ingredients or improved ways on giving them just that.

In fact, trends seem to indicate that meat alternatives sales in affluent markets (including even traditional German meat companies) are developing at the expense of meat: in 2016, sales of meat analog—also described as mock, veggie, or fake meat—are expected to register double-digit growth patterns, whereas meat sales will slightly decline.

This growth of meat-free foods is not even likely to be driven by vegetarians, but rather by Millennial consumers and their children who facilitate a long-term change in consumption habits.

THE FUTURE OF ANIMAL MEAT

Another driving factor for meat-free foods is also the increasing awareness of the sustainability of animal meat, both by consumers and the industry. Animal protein is the most vulnerable and resource-intense part of the world's food supply including an immense use of land and water, pollution and antibiotic abuse to keep animals "healthy".

By 2050, the global meat consumption is expected to increase by a staggering 40-50 percent compared to 2016. This huge increase will put enormous environmental and ecological strain on livestock farming. Presently, harvested crops are also facing competition from both animal and human nutrition. These two pathways are on a collision course, and something has to give sooner or later.

Every single week of the year, well over a billion animals are slaughtered worldwide and used as a source of animal protein for the human diet. When calculated per minute, this equals approximately 120,000 chickens, 2,800 hogs, 940 sheep, 800 goats, and 570 cattle. If fish were taken into the equation, these numbers would probably double, if not more.

In developed countries and affluent societies, the meat consumption per capita varies from about 50 kg per person to as much as 110 kg per person in the US. Most of the animals are raised on 'factory farms' under confined conditions.

Growth in population and disposable income will accelerate meat consumption for the foreseeable future. The growth curve of meat consumption has risen from 110 million metric tons (t) in 1975 to about 320 million t in 2014, and could reach some 470 million t in 2050.

The question is not 'if' but 'when' the world will reach the junction wherein the use of lean full-muscle meat in emulsified sausage and all-beef hamburgers can no longer be sustained. When that point arrives, meat processors will have no other alternative but to embrace other forms of alternative meat and protein ingredients to augment meat products. It is therefore essential to develop an economically, ethically, and nutritionally-tasty viable source of meat for the well-being of people.

THE SEARCH FOR ALTERNATIVE PROTEINS

To date, manufacturers have found countless meat and protein alternatives not only to address the increasing consumer demand for healthier foods, but also to address the issue of the sustainability of animal meat.

One such alternative that was popular for a period of time was soy protein. Viewed as the leaders of the meat alternatives market then, soy protein manufacturers included soy protein and soy flour in a variety of meat products. However, consumers soon began to show a strong dislike to these due to negative flavour associations, and because little or nothing was done to make the necessary changes to improve acceptance level, these manufacturers soon faded into the landscape and other alternatives were sought.

Today, cultured meat made from laboratory-grown bovine skeletal muscle stem cells and edible insects are slowly growing in popularity as meat and protein alternatives. The latter particularly is receiving growing interest and demand by consumers, since insects are comparable to livestock from a nutritional standpoint. Also, insects are very efficient in converting agricultural food waste to useful animal protein, and the lack of environmental impact from them would be able to stretch the sustainability and availability of animal protein.

However, coupled with negative consumer perceptions of insects as an alternative food, many questions remain to be answered before insect protein can become mainstream. These include those addressing the ethical nature of rearing insects for protein, and the uncertainty of the genetic make-up of insects having any sort of long-term effect on human health.

Instead of these, a real and sustainable alternative for meat and protein could lie in plants. In recent years, a real revolution is unfolding in the food world as scientists and technologists have made great progress in creating 'meat' from plant protein sources. These meat alternatives are not only healthy and sustainable, but they also could end up being cheaper than muscle meat.

PLANT MEAT—A REALISTIC FUTURE

While science and technology to date are not quite there yet, scientists and technologists have been able to create meat analogs such as beef crumbles and chicken strips made entirely of plant protein, but have an increasingly similar in taste and texture of animal protein, and an aura free from bioengineered foods.

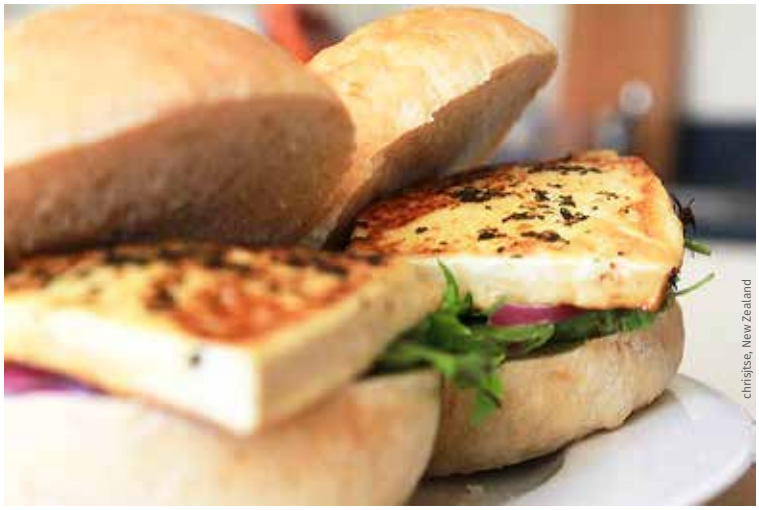
Through combining the virtues of plant protein and technology, plant proteins derived from soy and pea via a structuring process can be used to uniquely create and mimic meat-like alignment and fibrosity. This technology breaks away from the typical outdated extrusion processes of meat substitutes such as the textured soy flour, which often lacks the fibrous texture and has poor flavour and moisture retention.

PRODUCTION

The new generation of plant protein structures can be modelled in many different shapes, sizes and colours like nuggets, pellets, mince, flakes, and fibres. These products are often formulated using two main components—soy protein and wheat gluten, but plant protein ingredients can also include potato starch and functional plant fibres extracted from rice and fruit.

Gluten is typically considered the main ingredient for creating lamination of the extruded structured plant protein while soy or pea protein support the creation of the longitudinal formation of the fibres that mimic cooked meat fibrosity and appearance. As the composition of the extrusion formula largely determines the physical appearance and organoleptic attributes of the structured protein, changing the wheat and soy or pea protein ratio would modify the structure of a textured rehydrated plant protein particle.

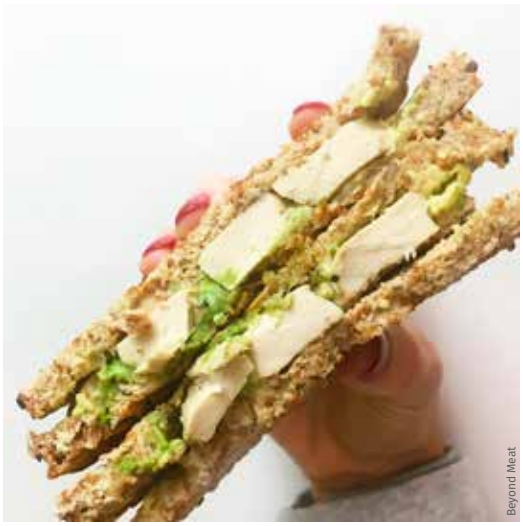
This ratio is therefore especially important in creating the elasticity and stress relaxation properties which duplicate the structure of muscle and thus enables a close mimicking of cooked meat.

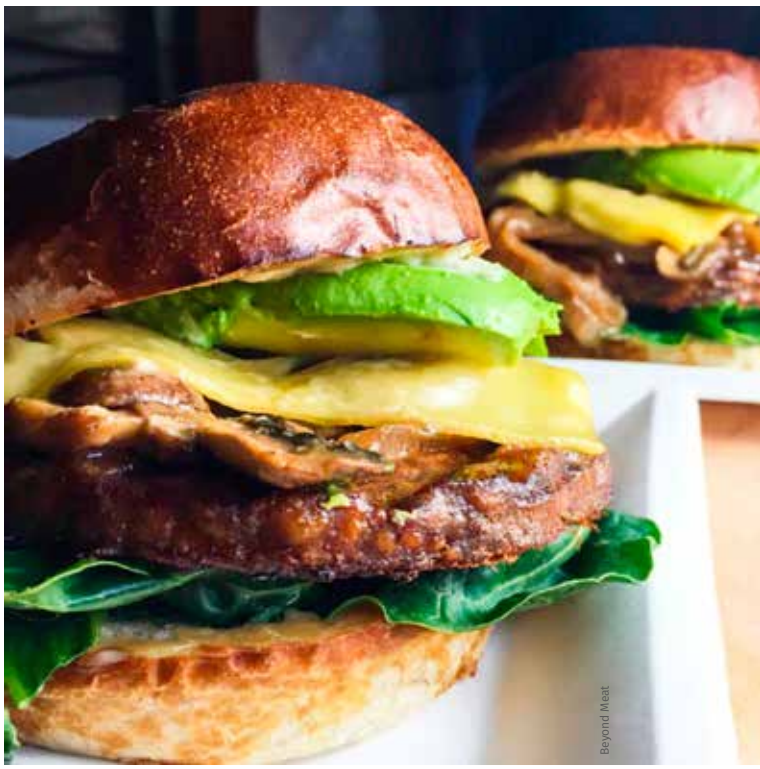


christse, New Zealand

Using only plant proteins, meatless burgers or even chicken sticks that not only look, but taste like the real thing can be made today.

Beyond Meat


Beyond Meat


Beyond Meat

For typical chicken or beef flavours, certain amino acids—the key component of sodium glutamate—can be used to create the much-heralded umami flavour, one of only five the tongue can perceive. The marinating can be done in large stainless vacuum tumblers that allow flavours such as hydrolysed plant proteins, yeast extracts, and seasoning or spices to diffuse into the structured plant protein membranes.

To simulate cooked beef colour, both caramel and malt can be used as a component of the plant meat. New technologies have been developed to include stable heat and colour forms of hydrolysed protein flavours. The inclusion level of these natural flavours is less than 1.0 percent and allows by-passing of flavour addition and diffusion when the final product is assembled in the processing plant.

Also noteworthy is the addition of minute amounts of titanium dioxide that can be used to camouflage the grey colour of the soy protein into something more appealing, such as the typical cooked chicken breast look.

PLANT PROTEIN CONTAINS NO CHOLESTEROL, TRANS FAT OR SATURATED FAT, AND WHILE LOOKING AND TASTING LIKE REAL MEAT, IS FROM CHEAPER AND MORE SUSTAINABLE SOURCES.

ADVANTAGES

Extruded structured plant protein made in this way might be able to replace lean meat entirely. Structured plant protein foods have a lot of advantages: no cholesterol, no trans fats or saturated fat, and are made of plant proteins free from antibiotics and hormones that are so typically used for lean meat today.

Also, typically absorbing two to four parts of water, plant protein structured products truly duplicate meat composition. By adding five percent of structured plant protein and 20 percent hydration water (1:4), an astounding 25 percent of meat equivalent can be replaced in almost any formulated coarse ground meat product. Swapping only 25 percent of meat for hydrated structured plant protein would definitely make a huge difference for the planet in the long term.

Though these premium structured 'plant meat' foods are priced higher than the average supermarket beef and chicken, plant proteins also allow for considerable cost savings when compared to lean beef, chicken and tuna, as their sources are more reliable and stable in price than meat. Further, plant proteins allow for sustainable sourcing including huge energy savings on refrigeration, logistics and warehousing.

Extruded structured plant protein fibres and chunks can also enhance or replace significant amounts of expensive meat sources. Most probably, beef and tuna foods will be the first to develop into 'fusion' or hybrid meat products or even muscle-free altogether. Beef, salmon, and tuna are expensive muscle foods, whereas, structured plant protein would not only deliver cost-savings but also contribute to a more efficient and economical use of transitional protein sources.

Even with the cheaper meats like chicken, structured plant protein can be infused with the meat to create a wide range of hybrid chicken products, like those appearing on menu boards of the world's largest fast food companies.

THE FUTURE OF MEAT

Despite all progress, meat analog foods can still be further improved. One of the most significant drawbacks is that most of these structured plant proteins are sold frozen to consumers or food service. Once the product is marinated and frozen, permeation of further flavour refinement is difficult to achieve. Also, the freeze/thaw cycle makes the textural properties suffer—most notably, its chewiness and graininess flaws.

For the future, to immediately reduce meat consumption, the way forward should be to choose a path in which lean meat is blended or infused with structured plant protein extrudates that ingeniously mimic beef, chicken or tuna. World-famous franchised restaurants have successfully introduced this concept by using this technology to offer affordable chicken patties, burgers, breakfast links, pizza toppings, and spaghetti meat sauce while maintaining nutritional value.

Existing formulated-meat products will likely undergo conceptual changes. For example, coextruded dumplings, hot dogs, hors d'oeuvres, pizza pepperoni, and burgers will continually evolve until they are no longer perceived primarily as a meat product, but rather as an infused food.

The same is true for hand-held 'pocket' foods. This category has expanded into a wide array of products for people who have little time or desire to sit down for the meal occasion. These products come in many varieties—from tortillas to a growing selection of mix-and-match foods based on ethnic preferences, flavour, and taste.

Wrapped or handheld foods may be considered as the beginning of the demise of meat as the main focal point of a meal is slowly being transplanted as food-on-the-go. Because a lot of these have meat as a characterising ingredient, this would likely be an area for future accelerated growth opportunities for plant-based meats.

The technology to create plant-based meats will grow to formidable importance and will be the key to the future of our planet. In the future, countries are expected to build manufacturing units to structure plant protein to augment meat, thus significantly stretching the available animal protein sources to its optimum qualitative and quantitative standards to feed the rapidly-growing populations, as well as help countries become self-supporting in food availability and security.

It is too early to tell if the success rate of this pathway will be able to replicate all the benefits of animal protein using the most traditional methods. There is little doubt that finding a true alternative to meat for the general public is by far the biggest obstacle to tackle. After all, eating meat is deeply embedded in emotional, cultural, religious and psychological associations. But, just as text messaging and emails have changed the way people communicate, society will change over time and adhere to a new identity to the food they eat. APFI