

PLANT MEAT: CARNIVORE NO MORE

By Henk Hoogenkamp

Part 1

The combination of population growth and rising environmental pressures means the new protein demand will have to be met by more than animals. There is no doubt that animal-free proteins eventually become a significant part of the global meat and dairy market. However, it is true that consumers experimenting with vegan, vegetarian or flexitarian lifestyles are often looking for plant-based foods similar to those they are cutting from their diet.

For plant-based alternatives, texture and flavor remain a huge challenge, not to mention that it may be surprising to consumers that many plant-based foods contain significantly less quality protein and thus these nutrients must be obtained from elsewhere.

The plant-based food industry has gone from being a relatively niche market to fully mainstream in a matter of only a few years. The plant-based foods category are those that directly replace animal products like meat,

fish, eggs, and dairy, as well as meals that contain direct replacements of these animal-based foods. These meat and dairy alternatives are not just for vegetarians or vegans anymore; now, even mainstream consumers are enjoying these much-improved innovative food options.

Protein remains an essential nutrient and the accelerating demand for vegan foods; the need for alternative plant protein sources is growing. People are mainly driven to select “plant-based” foods to achieve health benefits, including managing and avoiding diseases and weightloss. Almost a third of Americans are flexitarians, even if they do not recognize the term.

Animal-free Alternatives

An increasing number of people living in affluent societies consider the traditional meat industry ethically unsound, environmentally catastrophic and embedded in old-world thinking. For many, the logical way forward

is the promise of sustainable proteins and cleaner foods.

Plant-based proteins have already proved commercially successful, and will maintain momentum as the younger generations increase their purchasing power. Plant-based proteins are mostly appealing for women, millennials and their offspring. In very broad numbers, the developed countries and affluent societies, about 23 percent of the adult population is flexitarian, 5 percent is vegetarian and 2 percent is vegan. To put it in numbers: total retail food sales in the US and EU increased by just 2 percent in 2018. In comparison, plant-based meat sales are growing by over 20 percent.

Premiumization

Young people drive the trend of “no longer eating meat” and are the most likely to worry about meat ethics. There is little doubt that persistent media campaign promoting plant-based eating is contributing to the rise of meat-free diets.

In the plant world the terms “vegan” and “plant-based” might appear to be interchangeable, but the majority of consumers tend to see plant-based as a more defined and positive dietary choice. Somehow the word “vegan” is sub-consciously associated with deprivation and a serious commitment to a cause such as animal rights and environmental activism.

While plant-based protein consumption continues to gain traction, and the consumption of –particularly- red meat will be a slow path of decline in developed countries, it can be expected that the consumption of animal protein foods will evolve



in which premiumization will take center space -i.e. less quantity but higher quality.

“The Burger that Bleeds”

It is quite logical that the plant-based meat industry is mostly targeting the traditional beef burger market. Over 50 percent of the beef served

The mission of these companies is feeding the world’s burgeoning population with nutritious, tasty, affordable and environmentally-sound alternatives to traditional livestock-based systems of producing protein.

For the north American market burgers’ have always been the lowest hanging carnivorous fruit, so it is

Part of the charm of “plant-meat” foods is the marketing claim that these products are 95 percent more efficient in terms of land usage, 70 percent more efficient of water usage, and generates only a fraction of the greenhouse gas emissions of a traditional burger.

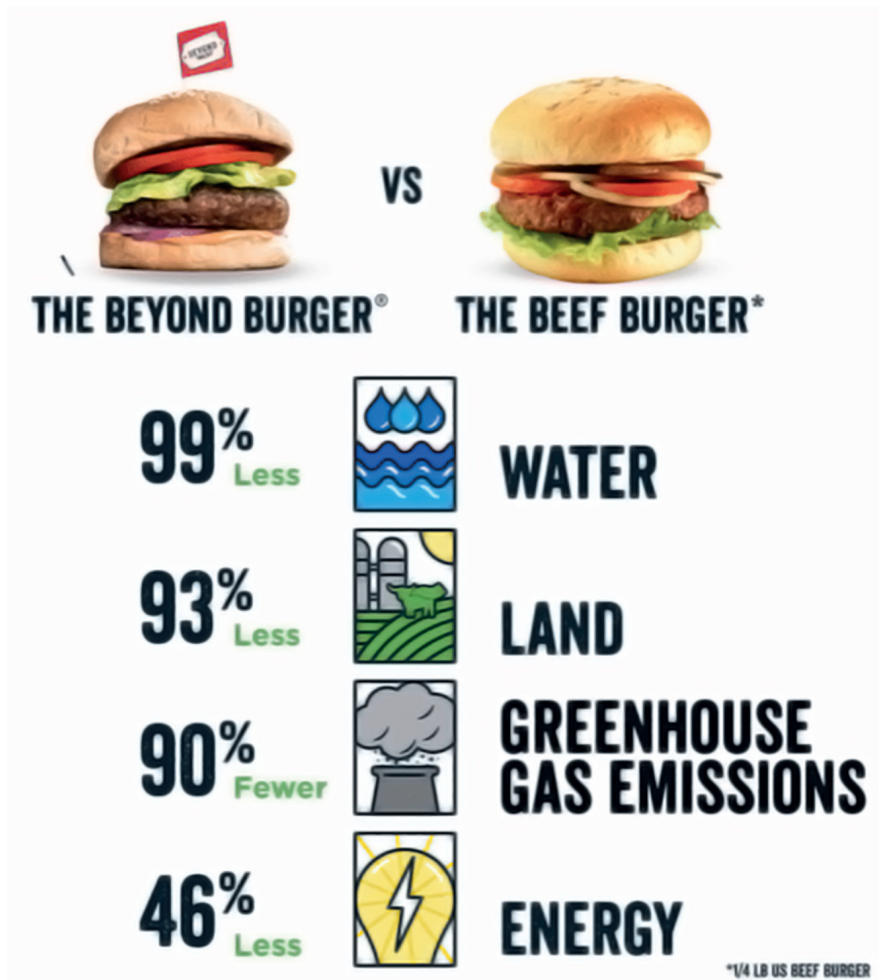
The plant-meat protein vision is not really new. Already since the end of World War 2 have American soy companies such as Central Soya, ADM, Cargill and Protein Technologies International, engaged in propaganda that going from plant to protein is much more efficient than translating anything through animals to create meat. (As a side note, it is generally accepted that the meat industry “love-hate” relationship with soy started in the mid 1950s when American soy companies tried to convince Europeans -who had been through the devastation of war- to eat “soy burgers”).

The inefficiencies of animal meat are not solely about ecological conditions and sustainability such as damaging the ecosystem, but equally important the avoidance of some negative safety concerns including cholesterol, hormones, antibiotics and slaughterhouse scandals.

There is a Limit to Animal Harvest Growth

By 2050, global meat consumption is expected to increase by a staggering 40-50 percent compared to 2019. This huge increase will put enormous environmental and ecological strain on livestock farming. Presently, harvested crops face competition from both animal nutrition and human nutrition. These two pathways are on a collision course, and something has to give sooner or later.

Sustainable livestock intensification, including heavier carcasses weight and improved feed to grain ratios; will be of paramount importance to balance food security. However, despite progress



in the US is ground beef, of which more than 50 percent is served in restaurants.

US alt.meat companies are clearly on a mission to replace the All-American burger with a plant-based alternative to ground beef. Both the Beyond Meat and Impossible burger (US) -as well the Moving Mountain burger (UK) are known as the plant-formulated “burger that bleeds”.

no surprise really that the alt.meat companies decided to target the foodservice and millennial consumer first. Seen through the eyes of the alt. meat entrepreneurs, animal farming is not scalable and is going to create huge environmental and ecological problems in the future. Seen from this perspective, the challenge is of feeding the world at a much lower environmental impact than the current animal-based methods.

made to improve livestock harvest, the overriding question remains that the world cannot push traditional meat production to astronomical levels without being penalized somewhere along the way.

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 added to the equation, these numbers would probably triple, if not more.

In developed countries and affluent societies, the meat consumption per capita varies from about 50 kilos per person to as much as 102 kilos per person in the US. Most of the animals are raised on "factory farms" under confined conditions. The UN Food and Agriculture Organization (FAO) has projected that chicken will soar past pork as the world's most-consumed meat by 2020.

In comparison: the global formulated plant meat industry selling "vega-foods" is expected to grow at a rate of 9.2 percent in 2019 with countries like the UK and Germany growing very rapidly with double digits reaching almost 20 percent.

Legal Definition

The Vegetarian Society of the UK coined the word "vegetarian" around 1847. The

word originates from the Latin language "vegetari", which means "to enliven".

The drafting of an implementing act regarding the suitability of a food for vegans and vegetarians seems to be not a priority in the US. A legal clarification concerning the use of "vegan" or "vegetarian" terms on food products at EU and US levels is not likely to occur in the near future. However, the European Commission has announced in November 2017, it will begin establishing a legal definition of vegetarian and vegan food in 2019. Finally, the consumers, as well as, the manufacturers and retailers will be able to rely on one set of rules for plant-based food.

Plant Meat: Not If But When

In order to create a healthy, humane and sustainable food supply, the current food platforms need to be transformed away from factory-farmed animal products and moving toward cultured meat and plant-based alternatives. New technology and techniques are needed to engineer plant-based meat alternatives, with animal meat-eaters as the main target. The most important factors of alt. meat products that still need further refinement are the key elements of taste, flavor, smell and texture. To accomplish these goals successfully, a multi-disciplinary approach is needed to yield optimal results.

The future will probably look different even though many meat-processing companies are obsessed with driving-out costs by targeting lean meat replacement as an obtainable goal.

The question is not "if" but "when" the world will reach the junction where 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 have no other alternative but to embrace transitional plant protein solutions to augment meat products. The leading transitional proteins are derived from soy, wheat, pea, and rice.

Today, the society relies on animals to turn plants into meat. In the future, a smarter way will prevail with meat made from plants ultimately transforming the global food system. Because no animals are needed, huge environmental, ecological and health advantages are achieved: No hormones, steroids, pathogens and antibiotics, less greenhouse gas emissions, significant clean water preservation and less land utilization.

Plant-based eating is not just about eating vegan, but rather a green evolution of social elements including animal welfare, sustainability, health and proactive living. Plant-based protein will be a big part of the food industry's future.

Real plant meat is a combination of amino acids - the building blocks of protein - some carbohydrates and vegetable oil, enriched with vitamins and minerals. These are the same components present in animal protein meat. Over the years, many names were coined to describe meat substitutes: mock meat, veggie meat, analog meat and fake meat. All of these names will slowly disappear from the vocabulary now that plant protein meat has reached the point of excellence wherein it can hardly be distinguished from animal-grown and harvested meat.

Vegan Food, are not of animal origin and in which, at no stage of production and processing, use has been made of or the food has been supplemented with:

- * Ingredients, including non-natural additives, carriers, flavorings and enzymes.
- * Processing aids
- * Substances which are not food additives but are used in the same way and with the same purpose as processing aids in either processed or unprocessed form that are of animal origin.

Vegetarian Food, meet the requirements of vegan foods with the difference that in their production, the following may be added or used:

- * Milk
- * Colostrum
- * Eggs
- * Honey
- * Beeswax
- * Propolis
- * Wool grease, including lanolin derived from the wool of living sheep or their components or derivatives.

A Game Changing Development

The future of world's food industry will increasingly focus to develop attractive products based on plant protein, as well as cellular agriculture, to create a sustainable and secure food solution for the rapidly growing populations.

As consumers look to decrease meat consumption, increasing number of people are choosing plant-based meat products. This trend is expected to further increase and, in fact, follows a similar trajectory as plant-based milk products that started to accelerate in 2010.

The plant-based meat market still has a long way to catch up the conventionally processed meat market. Globally, the processed meat is USD 148 billion (2018), far outpacing the USD 2.2 billion in packaged plant-meat sales. The gap is narrower in the US, where about USD 30 billion (2018) processed meat sales compare against USD 700 million in plant-meat sales. The top-five plant-based meat brands in the US by total sales are Morningstar Farms, Gardein, Beyond Meat, Boca Foods and Impossible Foods (US) LightLife (Maple Leaf Farms, Canada). The fastest growing brands in the category include Beyond Meat, Impossible Foods and Quorn. Whole Foods (an Amazon-owned company) carries most of the leading plant-based meat brands.

Although a great many people - especially millennials living in affluent societies - are actively cutting back on meat-based products, they do not wish to be labeled in a specific category of consumers. This indicates that a broader market may exist for plant-based protein foods beyond people who claim to be vegetarian.

For example, Australians have become more mindful in recent years about meat consumption for health and environmental concerns and the rapidly

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growing vegan market is reflecting this trend. Growing media coverage is helping to take the vegan cause further. Data search from Google Trends is showing an increase in interest in veganism from 2004 - 2018, with the top search countries being the US, UK, Germany, Austria, Israel, Australia, Canada, and New Zealand.

In the UK, food retailers like Sainsbury, Tesco and Waitrose have launched dedicated vegetarian sections, or stocking alternative products in the meat aisles, and focus on delivering high-quality plant-based products. The projected 2019 sales numbers show that the market for plant-based foods is growing rapidly and every

fourth meal in the UK is now vegan or vegetarian. Quorn is by far the lead selling brand in the UK.

In the UK, the plant-based meat substitute proteins are growing at 24 percent, and the plant-based milk category will be up 9 percent in 2019. There is a clear growing appetite for alternative “green” proteins as meat eaters have the desire to try something new. Generally speaking, a total of 7 percent of the UK population classifies themselves as vegetarian, with 4 percent pescetarian (only eating fish and dairy) and just 2 percent vegan.

Flexitarians –who cut down on meat consumption for health- or environmental reasons- make up a further 7 percent of the population. The UK has an estimated 24 million “flexitarians” –those who enjoy meat, but still are inclined to reduce it and substitute occasionally with plant-based meat foods. Many more people are interested in taking on some elements of a plant-based diet, even if they are not willing to commit full-time.

The supermarket focus is on challenging the meat and dairy category with tasty plant-origin alternatives. For consumers there is a clear and growing transitional awareness of avoiding meat and dairy products and is increasingly seen as the single most significant way to reduce environmental impact on the planet.

Veganomics

The past is our guide, but it need not dictate tomorrow. A real revolution is unfolding in the food world resulting in the very first meat analogs that taste like the real thing. In the last few years, scientists and technologists have made great progress and have come up with beef crumbles and chicken strips that have a structural biology entirely made from plant protein sources. What was formerly known as an “alternative” is now well

on its way to become “mainstream”. Ultimately, meat alternatives are not only healthy and sustainable, but also cheaper than muscle meat.

Plant meat foods are not only the opposite of the misery of industrial animal meat production, but also the invisible use of growth hormone, antibiotics, greenhouse gases, chemical fertilizers and clean water. It is estimated that about one-third of the land on Earth is used to raise livestock and their feed in order to keep the intensive animal farming systems afloat. All in all, plant meat foods are estimated to use 95 percent less resources than traditional farm-raised livestock.

Although plant-based diets are en vogue, there remain obstacles, which may deter people from making the switch. Moving to a whole food plant-based diet can be a roadblock if either a consumer and/or a medical doctor are ignorant about positive experiences or evidence. Often doctors are failing to do their duty by not offering a dietary solution for people (patients) with certain diseases and which may be at the end of the road for medical treatment and are not given the option of changing their diet.

A vegan diet can significantly reduce systematic inflammation and improve lipid profiles in patients with coronary artery disease. Reducing inflammation may help stave off heart attacks and strokes. Heart disease remains the leading cause of death for Americans, and time has come that therapeutic support becomes available beyond medication and procedures.

Vitamin B12 Alert

While it is true that predominantly plant-based diets have numerous benefits, they can also cause several underappreciated health problems. Especially vegan people who avoid animal food products such as dairy,

meat, fish and eggs, often do not get enough micronutrient B12, the much-needed vitamin that helps build red blood cells, repair DNA, and protect the brain.

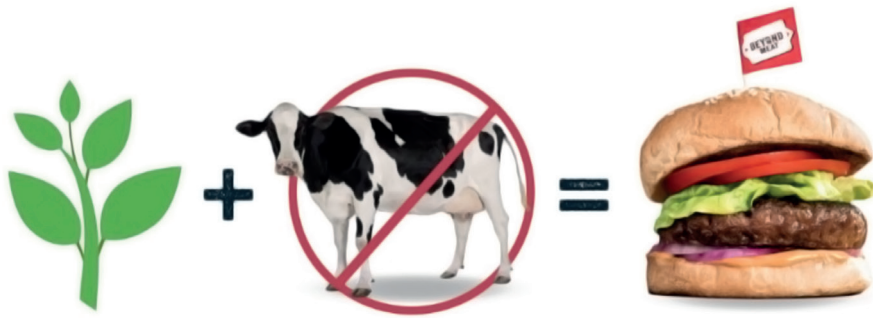
The symptoms of insufficient vitamin B12 intake start slowly, with indicators like fatigue, irritability and other mood swings, memory lapses, and pale skin. These symptoms can develop into more serious maladies such as vision loss and even psychosis, imbalance, and paralysis. In addition, B12 deficiency is also known to raise the risk of developing dementia, depression, cardiovascular disease, stroke, and even cancer.

Expectant mothers with B12 deficiency are up to five times more likely to have a child with a potentially disabling or fatal birth defect, many of which involves the brain or spinal cord.

Vitamin B12 might also affect the elderly who take heartburn medication to reduce stomach acids, patients with celiac or Crohn’s disease, and even people who have undergone gastric bypass surgery for obesity.

To overcome B12 intake shortage, supplementation is a wise step in order to avoid these slow progressing health problems. Vitamin B12 tablet/pills supplements are safe and inexpensive, while regular B12 injections are an alternative option for those people who have absorption problems.

For vegans it is very difficult or impossible to get an adequate supply of nutrients like vitamin B12. (German Nutrition Society, August 2016). It is estimated that about one-half of all dedicated vegans have a clinical vitamin B12 deficiency. Other potentially critical missing nutrients in an all-vegan diet include iron, while vegetarian meat substitutes often contain excessive amounts of sodium chloride to boost flavor and taste perception.



While vegan living on an individual basis is possible with a careful controlled and calibrated diet, it is difficult to scale up to a nationwide level. People who stick to a vegan diet permanently should take vitamin B12 supplements and select nutrient-dense (fortified) foods to ensure supply of essential or critical nutrients, especially indispensable amino acids, long-chain omega-3 fatty acids, vitamins like riboflavin, D, B12 and minerals like calcium, iron, potassium, iodine, zinc and selenium. All of the above are especially important to consider during pregnancy or lactation or for children or adolescents at all stages.

Transformational Plant World

The transformational journey from animal protein nutrition to plant protein nutrition is a long and winding road. It has taken a long time to create a meat analog product that is almost indistinguishable from animal protein. No doubt that the hot new trend is meatless meat (cultivated animal cells) and plant meat. The science and technology to date are not quite there yet, but a little more progress is made every day. The road to concoct a “veggie burger” that is juicy and flavorful with the right bite and texture is quite long and not easy to navigate. Fortunately, with the arrival of cellular agriculture, major development hurdles can now be successfully taken. In fact, assembling certain compounds and ingredients from plants allows a level playing field when compared to the

traditional formulated meat products, like burgers and chicken strips.

In the US, flexitarians outnumber vegetarians 3 to 1 and the EU is following closely behind. Germany and the UK have the highest penetration of the flexitarians consumers and the trend is accelerating to double-digit growth to drive the market for plant protein forward.

Flexitarians are a rapidly growing consumer segment aiming for transformative change, albeit often driven by psychologically and emotionally inclined aspects associated with animal welfare. Also, young and adolescent girls going through puberty often decide spontaneously to stop eating (red) meat.

Feedlot Meat

Humanity needs to feed a fast-increasing global population, and the planet should not be burdened with ever more livestock. Besides the unfathomable amounts of feed and water and land needed, cattle methane emissions are estimated to make up about 10 percent of greenhouse gas emissions worldwide.

In terms of ecological food sustainability, industrial scale feedlot meat production is probably the world’s largest environmental problem. Reducing meat consumption will free up vast amounts of land and water. Beef is generally considered the worst part of the meat pyramid because

of its very inefficient feed-to-meat conversion and the use of huge amounts of clean water during the outgrow cycle of the animal. Yet, on a worldwide basis, more than 50 percent of all beef is ground and ends up as a hamburger.

However, to be fair minded, a significant number of cattle graze on non-habitual unproductive agricultural land and as such contribute to the maintenance of main parts of the geographical infrastructure.

Meat happens to be incredibly tasty and nutritious and perhaps the only way to beat it is to develop a superior plant-based product that is at least equally good in organoleptic performance. The recent introduced plant-based burgers and sliders such as Impossible, Beyond Meat and Moving Mountains are well on their way to get to par with the meat burger equivalent.

There are major differences between animal meat and “plant-based meat”. Plants typically contain just a few percent of protein, while animal meat has an abundance of high-quality protein and a great mineral profile. These differences need to be brought in line and harmonized.

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