

# Plant-based protein

## An alternative approach to food



# Plant-based protein-An alternative approach to food

*Plant-based protein holds the same position in the food industry that Tesla does in the automotive industry. With an expected growth of USD10 billion by 2022<sup>1</sup>, it will potentially constitute one-third of the global food market by 2050<sup>2</sup>. The fourth Industrial Revolution<sup>3</sup> is underway and plant-protein is at the forefront of this much-needed transformation in agriculture<sup>4</sup>. Can plant-based food systems ensure global sustainability<sup>5</sup>?*

## What is plant-based protein and its history?

Protein means 'of primary importance' in Greek<sup>6</sup>. It is an important nutrient used by the body to build and repair tissues, make enzymes, hormones and other bodily chemicals. It is also an important building block for bones, muscles, cartilage, skin and blood<sup>7</sup>.

Protein is a "macronutrient" and a person needs a large amount of it to stay healthy. Unlike other macronutrients, the human body does not store protein<sup>8</sup>.

"Plant-based protein" is an alternative approach that considers the molecular structure of an animal product and reconstructs its primary features from plant-based raw material. This process saves natural resources by removing the inefficiency of funneling plants through an animal to make the end product<sup>9</sup>.

Historically, Egyptians in the 16<sup>th</sup> century and the gladiators in ancient Rome depended entirely on plant-based protein<sup>10</sup>.

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<sup>1</sup> Plant Based Protein Market Worth USD 10,892.3 Million By 2022, Meticulous Market Research Pvt. Ltd., 12 October 2017

<sup>2</sup> The future of food and agriculture – Trends and challenges, Food and Agriculture Organization of the United Nations, 2017

<sup>3</sup> The Fourth Industrial Revolution: what it means, how to respond, World Economic Forum – Geneva, Klaus Schwab, 14 January 2016

<sup>4</sup> Meet the food technology that may save the planet: Plant-based protein, One Green Planet, Nil Zacharias, 15 November 2017

<sup>5</sup> Is the Future of Sustainable Food in Plant-Based Foods? , Emily Holbrook, 3 October 2018

<sup>6</sup> Why Protein is Important, 8fit, 29 November 2017

<sup>7</sup> The Benefits of Protein, WebMD LLC., Neil Osterweil, Retrieved on 10 December 2018

<sup>8</sup> Ibid

<sup>9</sup> The Next Agricultural Revolution, A Medium Cooperation, 23 March 2018

<sup>10</sup> History of the Plant Based Diet, Fulton Massage Therapy, Brian Fulton, 21 November 2016

## Is this the solution for the global food gap?

*There exists a 70 per cent 'food-gap' between the crop calories available in 2006 and expected calorie demand in 2050.*

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A holistic approach to close the 'food-gap' includes production-based and consumption-based solutions<sup>12</sup>. Consumption-based solutions would include reducing over-consumption of calories by reducing over-intake of protein<sup>13</sup>, especially the over-consumption of animal-based foods<sup>14</sup>.

### The tide of fascination with “plant-based meat”

Plant-based protein is gaining popularity due to growing awareness about health, nutrition and negative environmental effects of modern industrial animal farming. This has caused an emerging shift towards plant-based protein alternatives from traditional animal-based protein<sup>15</sup>.

A decrease in eating meat will not only help sustain the planet by reducing emissions of carbon dioxide and methane from farmed animals; it will also save billions in health-care costs linked to chronic ailments for which consumption of meat is one possible causal factor<sup>16</sup>.

### Growth drivers

Faux meat in burgers and lab-grown chicken are becoming a fascinating new addition in menus across the globe<sup>17</sup>.

#### Health and flavor balance

Several plant-based meat substitutes designed to resemble, look and taste like animal-based foods have flooded the market<sup>18</sup>.

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<sup>11</sup> Shifting Diets for a Sustainable Food Future, World Resources Institute, Janet Ranganathan, Daniel Vennard, Richard Waite, Patrice Dumas, Brian Lipinski, Tim Searchinger and Globargi-WRR Model Authors, April 2016

<sup>12</sup> Ibid

<sup>13</sup> Ibid

<sup>14</sup> Ibid

<sup>15</sup> Plant-based diet gains in popularity for many reasons, Joelle Klein, 5 March 2018

<sup>16</sup> How to make global food systems more sustainable, The Conversation Media Group Ltd, Kathleen Kevany, 13 April 2018

<sup>17</sup> Vegan burgers: now juicy, pink and bloody, Rebecca Smithers, 19 May 2018

Consumers have been shown to prefer plant-based products which are high in protein, with no artificial ingredients and which are not genetically modified<sup>19</sup>.

### **Millennials and food-choices<sup>20</sup>**

Millennials, with over a trillion dollars in buying power, are leading the movement towards a plant-based lifestyle and are demanding more plant-based options. Much of the demand for plant-based “meat” products is coming from this demographic group.

### **Food technology and innovation**

The present food technology revolution is a response to the inherent deficiencies in animal agriculture<sup>21</sup>.

Advanced plant-based food with optimized taste, texture and nutrition is produced by creating animal proteins through yeast fermentation or cell culture techniques<sup>22</sup>.

These new plant-based and alternative protein products are occupying space in stores and on restaurant menus<sup>23</sup>.

### **Venture capitalists feed the frenzy**

*Presently the growth rate of “plant-based meat” is about twice that of traditional processed meat, with annual sales of USD2 billion.*

The plant-based protein phenomenon is seeing the early stages of a rapid scale-up of production and cost reduction<sup>24</sup>.

Since 2010 global sales of plant-based meat alternatives have grown on an average 8 per cent every year. Presently the growth rate of

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<sup>18</sup> What Millennials Can Teach Us About Plant-Based Eating, A Medium Corporation, Ronna Corlin, 6 December 2016

<sup>19</sup> Why plant protein is better for you than animal protein, Sara Chodosh, 14 June 2018

<sup>20</sup> Millennials to control as much as \$31 trillion by 2020, UBS says, 30 June 2017

<sup>21</sup> Plant-based profits: Investment Risks & Opportunities in sustainable food systems, Fair Initiative, February 2018

<sup>22</sup> Ibid

<sup>23</sup> Ibid

<sup>24</sup> Ibid

“plant-based meat” is about twice that of traditional processed meat, with annual sales of USD2 billion<sup>25</sup> .

Otsuka, a Japanese pharmaceutical company, acquired Canada's alternate foods company Daiya Foods in July, 2017 for USD324 million. This marked its first foray into the food industry<sup>26</sup>.

### **Use of Antibiotics<sup>27</sup>**

Globally, the largest consumer of antibiotics is the food industry and it is also a leading contributor to the rising and dangerous trend of antibiotic resistance among human beings.

More than 131,000 tons of medically important antibiotics were used on farm animals worldwide in 2013. It is estimated that India, China and US will increase their antibiotics usage by 82 per cent, 59 per cent and 22 per cent respectively by 2030. This tends to foster an immunity to antibiotics among those who consume such meat.

Plant-based protein promises to address this serious threat to public health.

### **Advocacy and regulation<sup>28</sup>**

Governments have started to recognize the impact of diets on the environment and climate. In 2015, the US government revised its dietary guidelines and advised the inclusion of key material environmental indications.

In Europe, Denmark is considering imposing a tax on red meat. In Sweden, the Green Party in 2016 called for the introduction of the climate tax on meat in the Swedish legislature.

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<sup>25</sup> Ibid

<sup>26</sup> Fake Meat, Non-Dairy Draw Hungry Investors, Merger Market, 1 November 2017

<sup>27</sup> Ibid

<sup>28</sup> Ibid

## Benefits of a plant-based food system

Plant-based proteins have been hailed for their potential benefits in terms of animal welfare, environmental-friendliness and human health<sup>29</sup>. Some benefits include:

- The consumption of plant based food can help in controlling weight, essentially leading to weight loss if the right plant-based foods are consumed<sup>30</sup>.
- A plant-based diet generally reduces the risk of type 2 Diabetes<sup>31</sup>.
- By reducing animal-based food consumption, the use of water would be reduced at least by half, since animal husbandry utilizes more than 50 per cent of fresh water<sup>32</sup>.
- Land used for raising livestock and the associated greenhouses gas emissions (principally carbon dioxide and methane) will also witness a substantial decrease<sup>33</sup>.

## Emerging markets

Annual global sales of plant-based meat alternatives have grown on an average 8 per cent a year since 2010. Currently, growth is about twice the rate of processed meat, with annual sales of about USD2 billion<sup>34</sup>.

This sector is expected to expand at a compound annual growth rate (CAGR) of approximately 8 per cent between 2017 and 2021, with the plant-based meat market set to reach around USD5 billion by 2020<sup>35</sup>.

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<sup>29</sup> Shifting diets for a sustainable food future, World Resources Institute, Janet Ranganathan, Daniel Vennard, Richard Waite, Patrice Dumas, Brian Lipinski, Tim Searchinger, and Globargi-WRR Model Authors, April 2016

<sup>30</sup> Ibid

<sup>31</sup> Animal vs Plant Protein - What's the Difference?, Mary Jane McCluggage, 17 June 2017

<sup>32</sup> The Case for Plant Based, UCLA: Sustainability, Dana Hunnes PhD, MPH, RD, Retrieved on 25 July 2018

<sup>33</sup> Ibid

<sup>34</sup> Ibid

## **Asia<sup>36</sup>**

Between 2012 and 2016, Southeast Asia alone saw an increase in non-vegetarian and vegan product launches by 140 per cent and 440 per cent respectively. The Asia-Pacific region is poised to register a growth rate of 6 per cent between 2017 and 2025.

Disposable income in the emerging markets will also grow and with it, health-consciousness in food choices. The average person's diet in China, with a population of 1.4 billion people, will come to resemble that of the average American.

## **USA**

Retail sales of plant-based foods that were directly replacing animal-based foods grew 20 per cent till June 2018. While plant-based milk sales grew 9 per cent, cow milk sales declined 5 per cent and are projected to drop another 11 per cent through 2020<sup>37</sup>.

## **Europe**

Meat substitutes in Europe accounted for 37 per cent of global sales in 2017<sup>38</sup>. Alternative proteins are expected to represent a third of the total EU protein demand growth in the next five years<sup>39</sup>.

In Germany, one in ten consumers is buying meat alternatives whereas 24 per cent Italian consumers are increasing the amount of vegetarian processed foods in their diets<sup>40</sup>.

## **Challenges ahead**

### **Technical challenges**

As cultured meat cells do not have an immune system, sterilization is a prerequisite. Thus, cultured meat will require more industrial energy

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<sup>35</sup> Ibid

<sup>36</sup> Ibid

<sup>37</sup> US sales of dairy milk turn sour as non-dairy milks sales grow 9% IN 2015, Mintel Press, Mintel Press Team, 20 April 2016

<sup>38</sup> Global Meat Substitute Market to Surpass \$6.5 Billion by 2026, Joe Loria, 6 September 2018

<sup>39</sup> Plant-based profits: Investment Risks & Opportunities in sustainable food systems, Fair Briefing

<sup>40</sup> Ibid

than livestock production, if it were to serve as a global protein alternative<sup>41</sup>.

Culturing of cells also holds the potential of genetic instability due to speedy growth leading to cancerous cell formation<sup>42</sup>. Therefore, the composition of the culture medium needs to meet the standards of growing cells and be considered safe for consumption<sup>43</sup>.

#### **Consumer attitudes<sup>44</sup>**

Most people are reluctant to try alternative foods due to persistent habits and historical traditions rooted in ethnic culture. These deeply-rooted habits will take a long time to change.

#### **Environment and Animal welfare**

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effort to meet the United Nations' Sustainable Development Goals would require GHG reduction in this sector<sup>45</sup>.

To fly the flag of sustainability, the alternative protein industry needs to control the unregulated use of antibiotics and take proper measures to ensure that businesses involved in this industry are not polluting the air and water<sup>46</sup>.

In 2014, two-peer related published studies predicted that agricultural emissions will take up the entire world's carbon budget by 2050, with

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<sup>41</sup> Ibid

<sup>42</sup> Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium, MDPI, Maeve Henchion, Maria Hayes, Anne Maria Mullen, Mark Fenelon and Brijesh Tiwari, 20 July 2017

<sup>43</sup> Ibid

<sup>44</sup> Ibid

<sup>45</sup> GLEAM 2.0 - Assessment of greenhouse gas emissions and mitigation potential, Retrieved on 30 January 2019

<sup>46</sup> Plant-based profits: Investment Risks & Opportunities in sustainable food systems, FAIRR Briefing, February 2018

livestock as the primary contributor, unless the trend of increased livestock production and consumption is not substantially decreased<sup>47</sup>.

## **Future outlook**

The last agricultural revolution domesticated farm animals. In this agricultural revolution, cells are being domesticated<sup>48</sup>.

The plant-based protein industry is backed by data, artificial intelligence, biochemistry and the entrepreneurial drive to solve some of the world's largest social and environmental problems<sup>49</sup>.

Investors using artificial intelligence to improve plant-based food technology believe that if they are successful, by the year 2030, there would exist a 15 per cent probability of feeding the world's population sustainably<sup>50</sup>.

Protein demand will grow as millions of poor people in less developed countries rise out of poverty and seek to consume more meat. While plant-based proteins are not a magic bullet, it is difficult to argue against the profound importance of this industry in meeting the rising global demand for meat in a sustainable and healthy manner<sup>51</sup>.

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<sup>47</sup> Ibid

<sup>48</sup> Is the Future of Meat Plant-Based?, Munchery, Andrew Mitchell, 2 January 2018

<sup>49</sup> Amazing ways artificial intelligence is driving the plant-based food revolution, Plant Based News, Kelly Holt, 23 August 2017

<sup>50</sup> Ibid

<sup>51</sup> Environmental impact of omnivorous, ovo-lacto-vegetarian, and vegan diet, Scientific Reports, Alice Rosi, Pedro Mena, Nicoletta Pellegrini, Silvia Turroni, Erasmo Neviani, Ilario Ferrocino, Raffaella Di Cagno, Luca Ruini, Roberto Ciati, Donato Angelino, Jane Maddock, Marco Gobetti, Furio Brighenti, Daniele Del Rio & Francesca Scazzina, 21 July 2017.