



PREHRANA TEMELJENA NA BILJNIM IZVORIMA

DARIJA VRANEŠIĆ BENDER

ZAŠTO „PLANT BASED”?

Mark Post, 325.000 USD vrijedan uzgojeni hamburger u *in vitro* uvjetima

2013



2019

Globalna kompanija Nestle lansirala „plant based”
burgere, Beyond Meat IPO

2050

Do 2050 globalna populacija dosegnut će 10 milijardi ljudi.



A portrait of David Attenborough, an elderly man with white hair, wearing a dark blue suit jacket over a light-colored shirt. He is looking directly at the camera with a slight smile. The background is a dark, deep space scene with the bright, curved horizon of the Earth visible on the right side, showing blue oceans and white clouds. The text "PLANET EARTH" is overlaid on the left side of the image.

PLANET EARTH

David Attenborough Wants You to Go
Plant-Based to Save the Planet

„PLANT BASED DIET”

DEFINICIJA

THE TERM "PLANT-BASED DIET" ENCOMPASSES A WIDE RANGE OF DIETARY PATTERNS THAT CONTAIN LOWER AMOUNTS OF ANIMAL PRODUCTS AND HIGHER AMOUNTS OF PLANT PRODUCTS SUCH AS VEGETABLES, FRUITS, WHOLE CEREALS, LEGUMES, NUTS AND SEEDS



Today's view of tomorrow's foods

Whether alternative protein sources, insect-fed chicken and fish, cultured meat, or algae, many technologies are being tested for the diet of tomorrow. With digital transparency across the value chain, health tracking and traceability are within reach.

TEXT: DANIEL RÖTTELE AND BEATRICE CONDE-PETIT / INFOGRAPHIC: DANIEL RÖTTELE

In the year 2050, there will be around 9.8 billion people on Earth according to the United Nations. Feeding them will require the production of a huge amount of protein each year – 50% more than today.

To keep both people and the planet healthy, we will have to change the way we think about consuming and producing foods. Biotechnology and digitalization are among the drivers of the transformation to come.

ALTERNATIVE PROTEINS

Insect-fed chicken and fish



Direct consumption

The demand for meat is expected to rise by 50% by 2050, which puts pressure on animal-feed and fish-food protein sources, such as soy and fish meal. Feeding chicken and farmed fish with insect proteins is more sustainable as insect production does not require arable land.

Processing

Insects are ideal for transforming organic waste into high-protein feed and fats for animals and fish. Bühler offers industrial solutions for processing the larvae of the black soldier fly. They live in high densities, can be mass reared on organic waste, and have a fast growth cycle.

Algae and seaweed



Direct consumption

Algae and seaweed contain valuable proteins, oils, and micro-nutrients. In modern bioreactors, micro-algae provide up to six times more protein per hectare than soy. Today, 30 million tons of seaweed are harvested a year. It has long been an esteemed food source in Asia.

Processing

Algae-based proteins can be mixed into bars, or processed into pasta and meat alternative products. Many dishes contain dyes or thickening agents made of algae. Today, Bühler offers bead mills that open the cell walls of micro-algae to harness valuable nutrients.

Pulses



Direct consumption

Pulses contain more protein than grains and require less fertilizer and water to grow. They are a good alternative to meat and are a widespread staple in Asian, Latin American and African cuisine. Between 2013 and 2017, 27,058 new products made with pulses came to market worldwide.

Processing

Pulses can be processed in many different ways: split peas, chickpeas, and lentils can be made into snacks, pasta, and baked goods. Plant-based egg substitutes made of mung beans already exist today and can be used to make scrambled eggs, for example.

Pasta made from pulses

TEXTURED PRODUCTS AS AN ALTERNATIVE TO MEAT

Bühler's modular twin-screw extrusion system enables flexible configuration.



Textured proteins

Meat alternatives are made from a variety of protein-rich, plant-based sources, such as soy, wheat or peas. Bühler offers solutions for texturing plant-based proteins that can be used for a variety of end products. Algae proteins are also gaining notice in the world of texturates.



DIGITALIZATION

Self-tracking and DNA analyses

Numerous fitness trackers and apps already exist today. In the future, health tracking and wearables are expected to grow in importance, for example with sensors that measure the blood sugar level via the skin. Start-ups already offer comprehensive DNA analyses of intestinal bac-

teria as a health indicator – together with personalized dietary recommendations. But the question arises: How reliable is this information? Does more insight really lead to lasting change in consumer behavior and improved health? And: who does the data belong to?

Digital technologies, IoT and Big Data

Transparency along the entire production chain is the key to food security, less fraud and efficient utilization of resources. Drones and satellites capture field data, while Big Data analyses warn of any contamination. Online sensors, the Internet of Things and blockchain enable end-to-end, unalterable

documentation of all steps in the value chain. As a result, food production can be monitored, allowing consumers to make founded purchase decisions based on information about origin, processing, and sustainability of the food. Today, Bühler already offers a range of digital solutions.

Biotechnology and genome editing



The pressure for greater sustainability and food security is the driving force behind cellular agriculture. Biotechnology offers enormous potential for developing food for humans and animals using yeasts, bacteria, algae or animal cells. Gene technology is also becoming more important in reducing the carbon

and water footprint of the food chain. For example, a US start-up is developing a cow-less milk that is brewed in a fermenter. In addition, labs across the globe are researching the new genome editing method CRISPR/Cas9 in an attempt to cultivate plants resistant to certain diseases.

Meat straight from the lab

Many people love meat. With the middle class growing in threshold countries, global consumption is set to rise dramatically. Current meat production is already placing excessive strain on the planet: major demand for feed weighs heavily on our carbon footprint, while bacteria resistant to antibiotics used in factory farming are a threat to

health. We need alternatives. Numerous smart-ups and researchers are working on new ways to produce meat without breeding and slaughtering animals by growing animal muscle cells in a nutrient solution. The challenges are: keeping meat production cost-effective and what consumers will think of meat coming from labs.

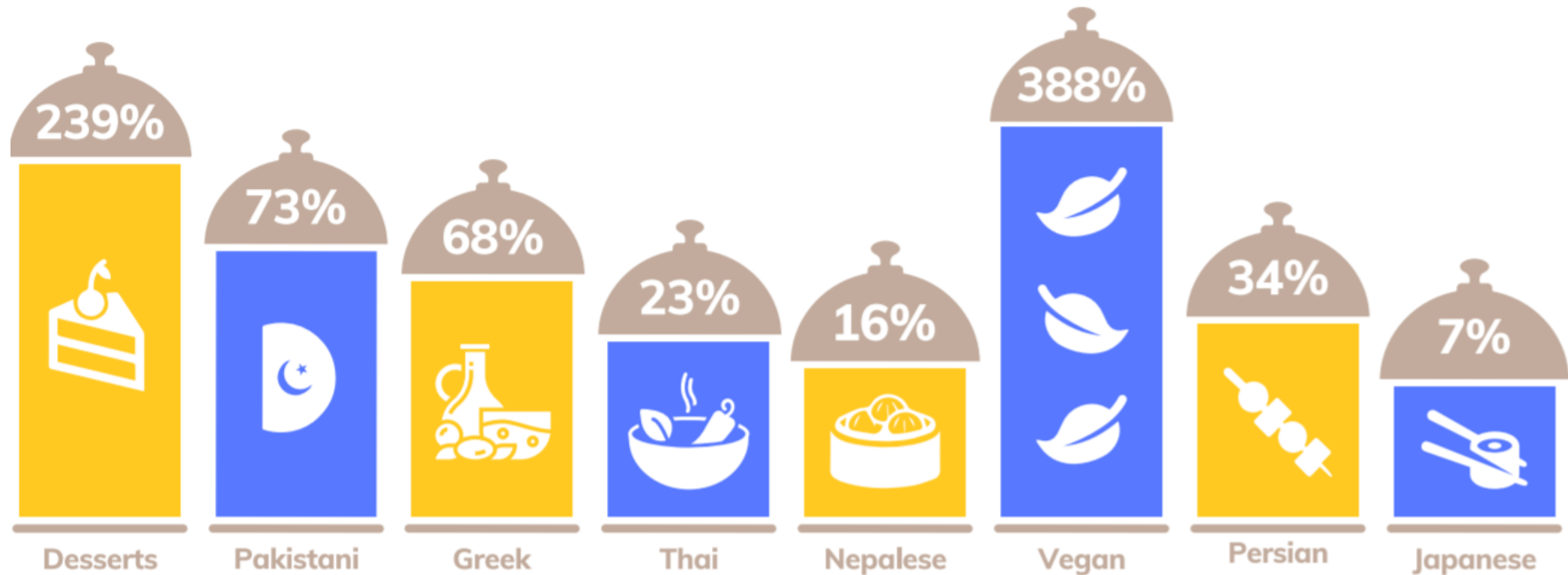


What does the future hold?

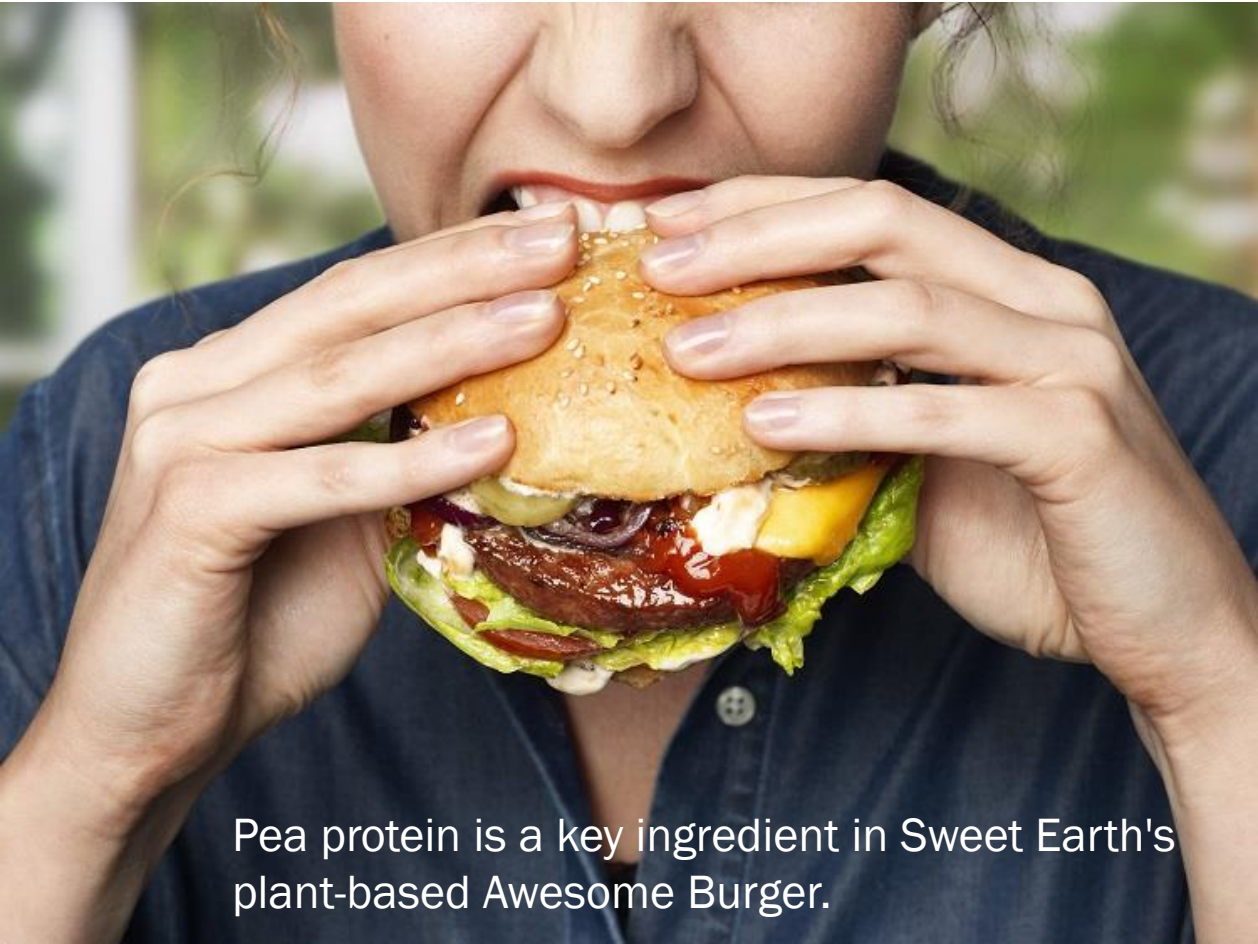
Many food trends are still in the start or developmental phases. The technologies that come out on top will also depend on what can be accomplished both efficiently and ecologically, and whether they are safe. And, consumers have to trust the new products.

HRANA IZ DOSTAVE: TRENDovi RASTA U VELIKOJ BRITANiji

Some of the fastest-growing cuisines 2016-2018



2019: KOMERCIJALNI BURGERI NA BILJNOJ OSNOVI



Pea protein is a key ingredient in Sweet Earth's plant-based Awesome Burger.



How the competition stacks up
A side-by-side look at the nutritional profiles of 4 oz plant-based burgers compared to a beef burger.

	Beef burger 80% lean, 20% fat beef	Awesome Burger pea-based protein	Beyond Burger pea-based protein	Impossible Burger soy-based protein
Protein	19g	26g	20g	19g
Fat	23g	15g	18g	14g
Fiber	0g	6g	2g	3g



#GatesPartner

Feeding Bill Gates a Fake Burger (to save the world)

42,723,212 views • Feb 12, 2020

👍 1.2M 👎 38K ➦ SHARE ➦+ SAVE ...



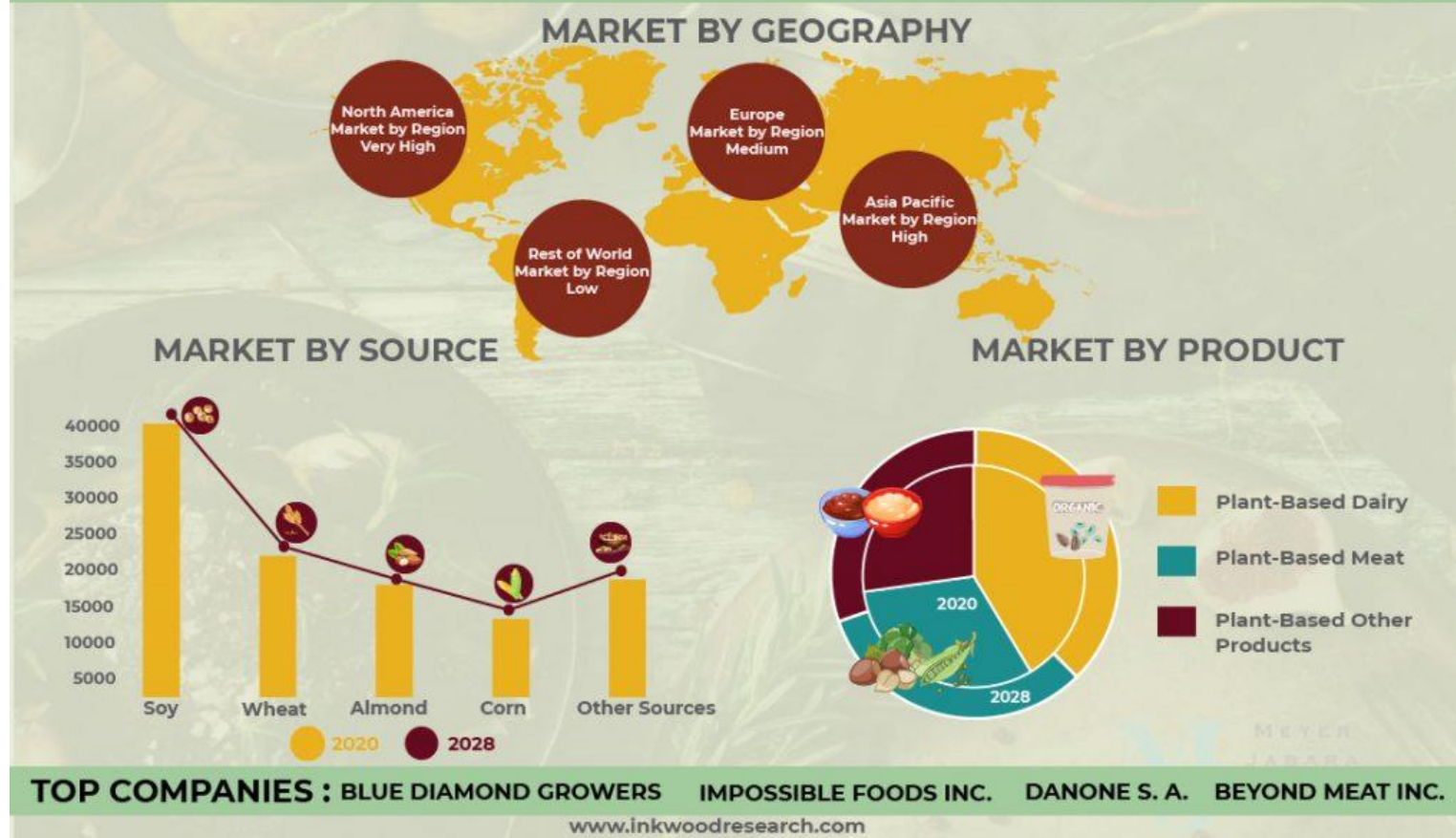
Mark Rober ✓
19.8M subscribers

SUBSCRIBE

TRENDVI RASTA 2021 - 2028

- The global plant-based food and beverage market is expected to reach \$95.41 billion by 2028

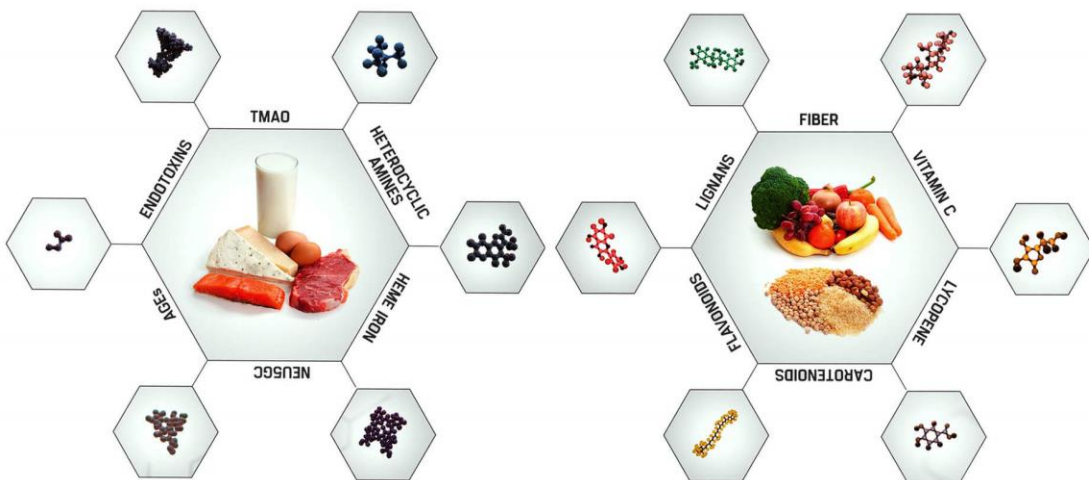
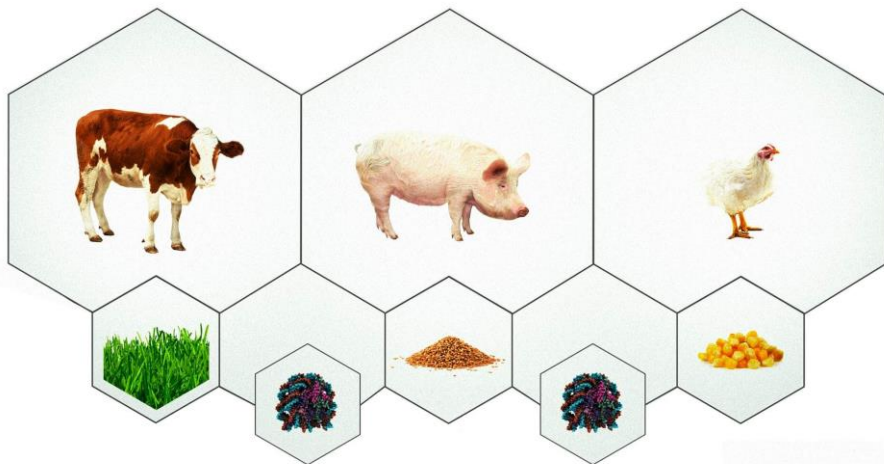
GLOBAL PLANT-BASED FOOD AND BEVERAGE MARKET 2021-2028



Country ▼	Vegetarians (%) ♦	Approx. No. of individuals ^[3] ♦	Source Year ♦
 Australia	5.0%	1,105,000	(2010) ^[4]
 Austria	9.0%	765,000	(2013) ^[5]
 Brazil	8.0%	15,896,000	(2012) ^[6]
 Canada	4.0%	1,264,000	(2003) ^[7]
 China	4.0% - 5.0%	54,428,000—68,035,000	(2013) ^[8]
 Denmark	4.0%	220,000	(2011) ^[9]
 Finland	5.0%	274,000	(2014) ^[10]
 France	2.0%	1,306,000	(2011) ^[11]
 Germany	9.0%	7,371,000	(2009) ^[12]
 India	31.0% - 40%	392,890,000-506,960,000	(2006) ^[13]
 Israel	13.0%	1,078,000 ^[14]	(2015) ^[15]
 Italy	10.0%	6,010,000	(2009) ^[16]
 Japan	4.7%	5,964,300	(2014) ^[17]
 Netherlands	4.5%	738,000	(2008) ^[18]
 New Zealand	1.0% - 2.0%	39,000—78,000	(2002) ^[19]
 Poland	3.2%	1,228,800	(2013) ^[20]
 Portugal	0.3%	31,629	(2007) ^[21]
 Russia	3.0% - 4.0%	4,380,000—5,840,000	(2014) ^{[22][23]}
 Spain	4.0%	1,788,000	(2007) ^[24]
 Sweden	10.0%	970,000	(2014) ^[25]
 Switzerland	5.0%	375,000	(2007) ^[26]
 Taiwan	13.0%	2,964,000	(2007) ^[27]
 United Kingdom	7.0% - 11.0%	7,095,000	(2002) ^[28]
 United States	1.9%	6,140,000	(2014) ^[29]

PLANT-BASED VS. VEGETARIJANSTVO

- Vegetarijanstvo u HR: 3-5%
- Plant – based prehrana je namijenjena svima
- Proizvodi se formuliraju i pozicioniraju za „mesojede”
- Povremeno uklapanje „plant-based” proizvoda iz trenda s vremenom prerasta u mainstream



Plants foods such as beans, lentils, nuts, whole grains, and veggies provide a fantastic source of protein without the added drawbacks of meat.

PLANT PROTEIN

per serving

ADVANTAGES

- Fiber
- Phytonutrients
- Vitamins & minerals
- Low or healthy fat profile
- No cholesterol

18g

Red Lentils
boiled, 1 cup



17g

Edamame
boiled, 1 cup



15g

Black Beans
cooked, 1 cup



6g

Almonds
1 oz



5g

Peas
cooked, 1 cup



5g

Baked Potato
1 medium



5g

Spinach
boiled, 1 cup



ANIMAL PROTEIN

per serving

DISADVANTAGES

- Cholesterol
- Saturated fat
- No fiber
- Higher in calories

6g

Egg
cooked, 1



20g

Salmon
cooked, 3 oz



25g

Steak
cooked, 3 oz



25g

Chicken
cooked, 3 oz



Eating minimally processed whole plant foods such as vegetables, fruits, whole-grains, legumes, and nuts lower the risk of diabetes, heart disease, cancer, and promote overall health.

Source: USDA Nutrient Analysis Database

BIOLOŠKA VRIJEDNOST PROTEINA

$$BV = \frac{\text{retained N}}{\text{absorbed N}} = \frac{[N \text{ intake}] - [\Delta \text{ fecal N}] - [\Delta \text{ urinary N}]}{[N \text{ intake}] - [\Delta \text{ fecal N}]}$$

- Proteini visoke biološke vrijednosti su oni s visokom probavljivošću koji ujedno sadrže sve esencijalne aminokiseline i osiguravaju optimalnu izgradnju proteina u tijelu
- Riječ “kvaliteta” ili „kakvoća” asocira na superiornost, ali izvore hrane proteina "visoke kakvoće", kako je definirano postojećom metrikom, ne možemo uvijek povezati s povoljnim zdravstvenim učincima i poboljšanjem kvalitete prehrane
- Životinjski vs biljni izvori proteina: pitanje zdravstvenih čimbenika i održivosti /utjecaja na okoliš
- Predlaže se uvođenje modernizirane metrike kakvoće proteina, koja uzima u obzir ne samo kvalitetu aminokiselinskog profila nego i utjecaj na zdravlje čovjeka i okoliš

Perspective: The Public Health Case for Modernizing the Definition of Protein Quality

David L Katz,¹ Kimberly N Doughty,¹ Kate Geagan,² David A Jenkins,³ and Christopher D Gardner⁴

¹Yale–Griffin Prevention Research Center, Griffin Hospital and Yale School of Public Health, Derby, CT; ²Kate Geagan Nutrition, Hailey, ID; ³Department of Nutritional Sciences, Faculty of Medicine, University of Toronto, Toronto, Canada; and ⁴Stanford Prevention Research Center, Stanford University, Stanford, CA

TABLE 1 Sample modernized protein rating metrics¹

Criterion	Maximum score	Beef, most cuts ²	Beef, extra lean ²	Dark meat chicken, with skin ³	Skinless chicken breast ³	Low-fat milk ²	Soy ²	Chickpeas ⁴	Almonds ³	Pistachios ³	Whole-grain wheat ²	Brown rice ³
Sample metric 1: stand-alone rating system												
PDCAAS (>80: 2; 50 to <80: 1; 30 to <50: 0; <30: −1)	2	2	2	2	2	2	2	1	0	1	0	1
Recommended for health (recommended: 2; no mention: 0; discouraged: −1)	2	−1	2	−1	2	2	2	2	2	2	2	2
Environmental impact (low: 2; medium: 0; high: −1)	2	−1	−1	2	2	0	2	2	2	2	2	2
Total	6	0	3	3	6	4	6	5	4	5	4	5
Sample metric 2: metric used as an adjustment factor												
PDCAAS (range: 0.0–1.0)	1	0.92	0.92	0.94	0.94	1.0	0.92	0.52	0.43	0.73	0.42	0.69
Recommended for health (recommended or no mention: 1; discouraged: 0)	1	0	1	0	1	1	1	1	1	1	1	1
Environmental impact (low: 1; medium: 0.5; high: 0)	1	0	0	1	1	0.5	1	1	1	1	1	1
Average score	1	0.31	0.64	0.65	0.98	0.83	0.97	0.84	0.81	0.91	0.81	0.90

¹PDCAAS, Protein Digestibility-Corrected Amino Acid Score.

²Data from reference 24.

³Data from reference 25.

⁴Data from reference 26.

SMANJENJE KARDIOVASKULARNOG RIZIKA

- Smanjenje rizika:
 - koronarne bolesti srca za 40 %
 - cerebrovaskularnih bolesti za 29%
 - dijabetesa tip 2 i metaboličkog sindroma za 50%



nutrients



Review

Cardio-Metabolic Benefits of Plant-Based Diets

Hana Kahleova ^{1,*} , Susan Levin ¹ and Neal Barnard ^{1,2}

¹ Physicians Committee for Responsible Medicine, 5100 Wisconsin Ave, N.W. Ste.400, Washington, DC 20016, USA; slevin@pcrm.org (S.L.); nbarnard@pcrm.org (N.B.)

² George Washington University School of Medicine and Health Sciences, Washington, DC 20052, USA

* Correspondence: hKahleova@pcrm.org; Tel.: +1-202-527-7379

Received: 17 June 2017; Accepted: 3 August 2017; Published: 9 August 2017

Abstract: Cardio-metabolic disease, namely ischemic heart disease, stroke, obesity, and type 2 diabetes, represent substantial health and economic burdens. Almost one half of cardio-metabolic deaths in the U.S. might be prevented through proper nutrition. Plant-based (vegetarian and vegan) diets are an effective strategy for improving nutrient intake. At the same time, they are associated with decreased all-cause mortality and decreased risk of obesity, type 2 diabetes, and coronary heart disease. Evidence suggests that plant-based diets may reduce the risk of coronary heart disease events by an estimated 40% and the risk of cerebral vascular disease events by 29%. These diets also reduce the risk of developing metabolic syndrome and type 2 diabetes by about one half. Properly planned vegetarian diets are healthful, effective for weight and glycemic control, and provide metabolic and cardiovascular benefits, including reversing atherosclerosis and decreasing blood lipids and blood pressure. The use of plant-based diets as a means of prevention and treatment of cardio-metabolic disease should be promoted through dietary guidelines and recommendations.

Keywords: cardio-metabolic; diet; nutrition; plant-based; vegan; vegetarian

DIJETE S VISOKIM UDJELOM BILJNIH IZVORA

Visoka nutritivna gustoća

Bolja kontrola tjelesne mase i glikemije

Metaboličke i kardiovaskularne blagodati

Prevenција malignih bolesti

Niži mortalitet

PREDLOŽENI MEHANIZMI DJELOVANJA:

- Niži kalorijski unos
- Povećan unos vlakana
- Smanjen unos zasićenih masti i kolesterola
- Povećan unos nezasićenih masti, antioksidansa, mikronutrijenata
- Povećan unos proteina biljnog porijekla
- Povećan unos biljnih sterola

UTJECAJ NA MIKROBIOTU

■ Toribio-Mateas, M.A.; Bester, A.; Klimenko, N. Impact of Plant-Based Meat Alternatives on the Gut Microbiota of Consumers: A Real-World Study. *Foods* 2021, 10, 2040.



Article

Impact of Plant-Based Meat Alternatives on the Gut Microbiota of Consumers: A Real-World Study

Miguel A. Toribio-Mateas ^{1,2,*}, Adri Bester ¹ and Natalia Klimenko ^{3,4}

¹ School of Applied Sciences, London South Bank University, London SE1 0AA, UK; bestera@lsbu.ac.uk

² School of Health and Education, Middlesex University, London SE1 0AA, UK

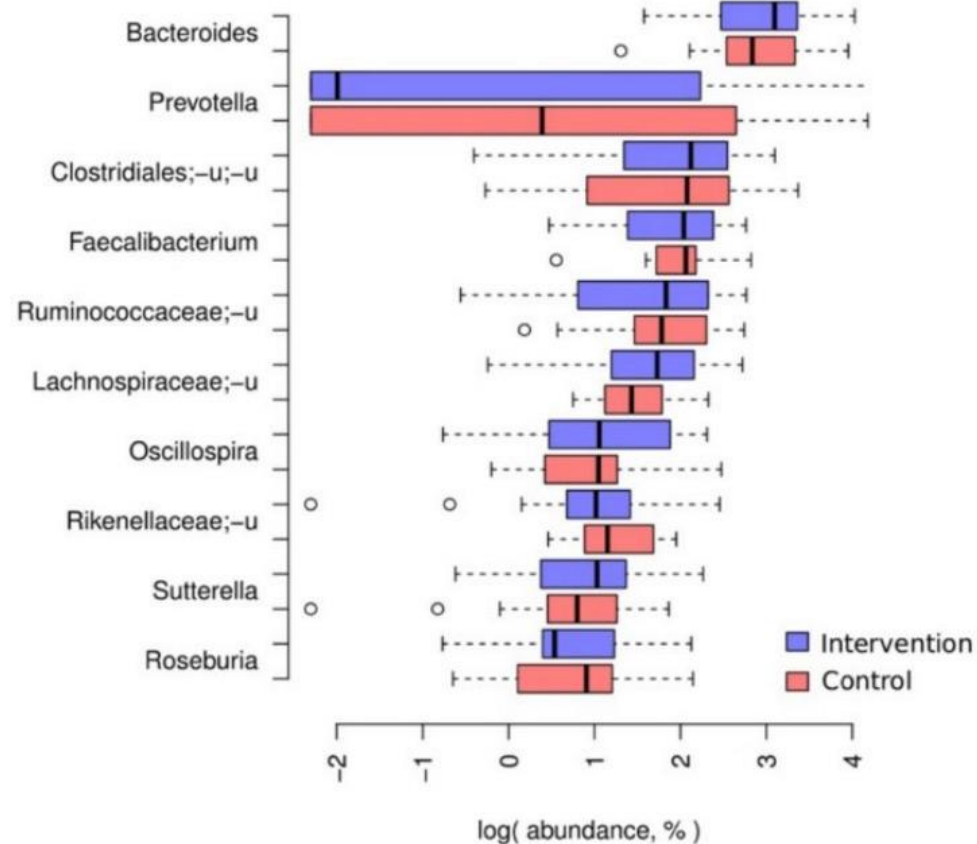
³ Center for Precision Genome Editing and Genetic Technologies for Biomedicine, Institute of Gene Biology, Russian Academy of Sciences, 119334 Moscow, Russia; lklimenko@genebiology.ru

⁴ Research and Development Department, Knomics LLC, Skolkovo Innovation Center, 121205 Moscow, Russia

* Correspondence: toribiom@lsbu.ac.uk

Abstract: Eating less meat is increasingly seen as a healthier, more ethical option. This is leading to growing numbers of flexitarian consumers looking for plant-based meat alternatives (PBMA) to replace at least some of the animal meat they consume. Popular PBMA products amongst flexitarians, including plant-based mince, burgers, sausages and meatballs, are often perceived as low-quality, ultra-processed foods. However, we argue that the mere industrial processing of ingredients of plant origin does not make a PBMA product ultra-processed by default. To test our hypothesis, we conducted a randomised controlled trial to assess the changes to the gut microbiota of a group of 20 participants who replaced several meat-containing meals per week with meals cooked with PBMA products and compared these changes to those experienced by a size-matched control. Stool samples were subjected to 16S rRNA sequencing. The resulting raw data was analysed in a compositionality-aware manner, using a range of innovative bioinformatic methods. Noteworthy changes included an increase in butyrate metabolising potential—chiefly in the 4-aminobutyrate/succinate and glutarate pathways—and in the joint abundance of butyrate-producing taxa in the intervention group compared to control. We also observed a decrease in the *Tenericutes* phylum in the intervention group and an increase in the control group. Based on our findings, we concluded that the oc-

Citation: Toribio-Mateas, M.A.; Bester, A.; Klimenko, N. Impact of Plant-Based Meat Alternatives on the Gut Microbiota of Consumers: A Real-World Study. *Foods* 2021, 10, 2040. <https://doi.org/10.3390/>



UTJECAJ NA MIKROBIOTU

- 16S rRNA sekvencioniranje uzoraka stolice ispitanika koji su zamijenili ~5 obroka/tjedan koji su sadržavali animalne izvore s plant-based mješavinama i proizvodima koji služe kao zamjene za meso, a rezultati su uspoređeni s kontrolnom skupinom
- Povremena zamjena animalnih izvora s plant-based mesnim alternativama (PBMA) što je svojstveno fleksitarijanstvu može potaknuti pozitivne promjene crijevne mikrobiote

DO 2050. TRANSFORMACIJA PREMA ZDRAVIJOJ PREHRANI ZAHTIJEVA KORJENITE PROMJENE



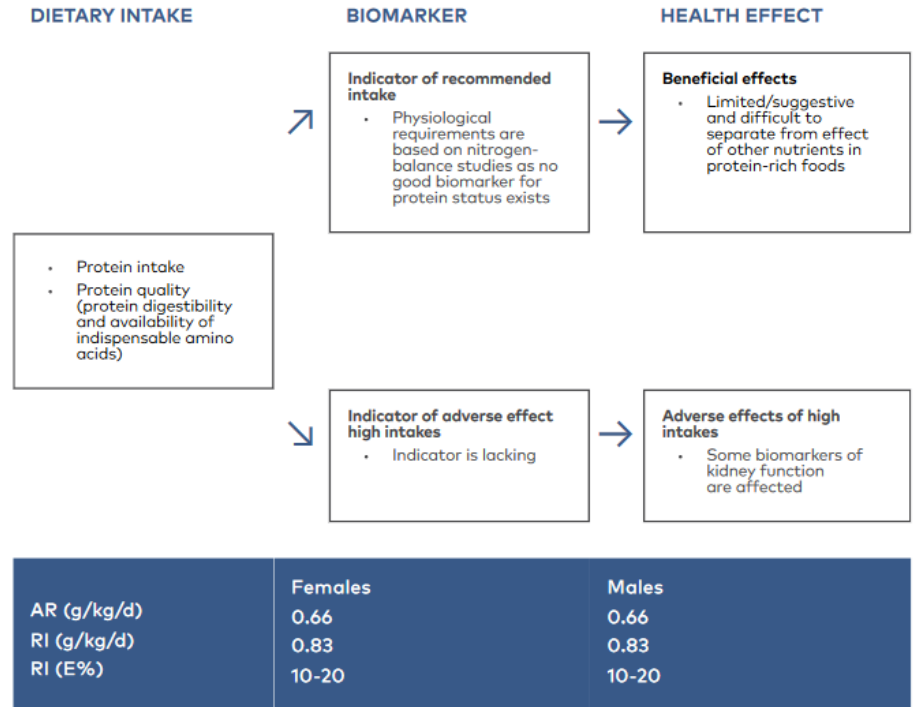
- Udvostručiti konzumaciju voća, povrća, orašastih plodova, mahunarki kako bi prihvatili prehranu na biljnoj osnovi
- Konzumaciju crvenog mesa i šećera smanjiti za 50%
- Uloga namirnica životinjskog podrijetla u prehrani ljudi - pažljivo promisliti u kontekstu lokalne i regionalne stvarnosti
- Hranu i prehranu gledati kao na dio održivog sustava proizvodnje hrane (cirkularna ekonomija)

NORDIC NUTRITION RECOMMENDATIONS 2023

INTEGRATING ENVIRONMENTAL ASPECTS



Protein



” Dietary proteins of animal origin or a combination of plant proteins from, for example, legumes and cereal grains, give a good distribution of essential amino acids. **Replacing a part of animal proteins in the current Nordic diet with plant proteins** would provide enough protein and essential amino acids at recommended protein intake levels



Deutsche Gesellschaft
für Ernährung e.V.

[Blog](#)

[Veranstaltungen](#)

[Presse](#)

[MedienShop](#)

 [Leichte Sprache](#)

 [English](#)

DGE

Wissenschaft

Gesunde Ernährung

Gemeinschaftsgastronomie

Qualifizierung



ERNÄHRUNGSEMPFEHLUNGEN FÜR DEUTSCHLAND

Gut essen und trinken – die DGE- Empfehlungen

[ZU DEN EMPFEHLUNGEN](#)

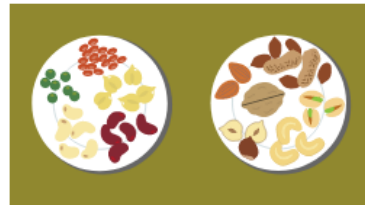
Obst und Gemüse – viel und bunt

Obst und Gemüse liefern reichlich Vitamine, Mineralstoffe, Ballaststoffe sowie sekundäre Pflanzenstoffe. Sie sind gut für die Gesundheit und tragen zur Sättigung bei. Genießen Sie mindestens 5 Portionen Obst und Gemüse pro Tag, am besten in ihrer jeweiligen Erntesaison.



Hülsenfrüchte und Nüsse regelmäßig essen

Hülsenfrüchte wie Erbsen, Bohnen und Linsen sind reich an Eiweiß, Vitaminen, Mineral- und Ballaststoffen sowie sekundären Pflanzenstoffen. Nüsse liefern zusätzlich lebensnotwendige Fettsäuren und sind gut für die Herzgesundheit. Verzehren Sie mindestens einmal in der Woche Hülsenfrüchte und täglich eine kleine Handvoll Nüsse.



Vollkorn ist die beste Wahl

Bei Getreideprodukten wie Brot, Nudeln, Reis und Mehl ist die Vollkornvariante die beste Wahl für die Gesundheit. Lebensmittel aus Vollkorn sättigen länger und enthalten mehr Vitamine und Mineralstoffe als Weißmehlprodukte. Insbesondere die Ballaststoffe im Vollkorn senken das Risiko für viele Krankheiten.



Milch und Milchprodukte jeden Tag

Milch und Milchprodukte liefern insbesondere Eiweiß, Calcium, Vitamin B₂ und Jod und unterstützen die Knochengesundheit. Werden pflanzliche Milchalternativen verwendet, ist auf die Versorgung mit Calcium, Vitamin B₂ und Jod zu achten.



Fisch jede Woche

Fette Fische wie Lachs, Makrele und Hering liefern wertvolle Omega-3-Fettsäuren. Seefisch wie Kabeljau oder Rotbarsch enthält zudem Jod.

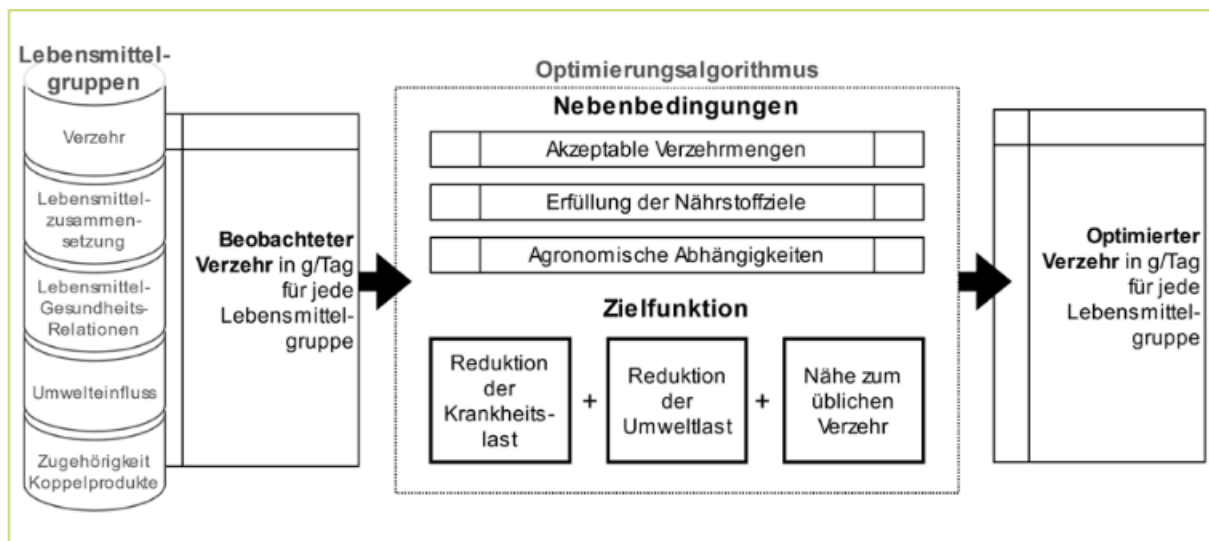
Essen Sie ein- bis zweimal Fisch pro Woche.



Fleisch und Wurst – weniger ist mehr

Fleisch enthält gut verfügbares Eisen sowie Selen und Zink. Zu viel Fleisch von Rind, Schwein, Lamm und Ziege und insbesondere Wurst erhöhen das Risiko für Herz-Kreislauf-Erkrankungen und Dickdarmkrebs. Die Produktion von Fleisch und Wurstwaren belastet die Umwelt deutlich stärker als die von pflanzlichen Lebensmitteln. Wenn Sie Fleisch und Wurst essen, dann nicht mehr als 300 g pro Woche.





Lebensmittelgruppe	Portion in g	Bezeichnung	Anzahl Portionen für Modellvariante 3		Zeitbezug
			Szenario 1	Szenario 2	
Obst und Gemüse	110	Portion	5	5	täglich
Säfte	200	Glas	2	2	wöchentlich
Pflanzliche Öle	10	Esslöffel	1	1	täglich
Hülsenfrüchte	125	Portion (frisch ¹)	1	1	wöchentlich
Nüsse und Samen	25	Portion	1	1	täglich
Kartoffeln	250	Portion	1	1	wöchentlich
Getreide, Brot, Nudeln ² davon mind. 1/3 Vollkorn	60	Portion	5	5	täglich
Milch und Milchprodukte	250 ³	Portion	2	2	täglich
Eier	60	Stück	1	1	wöchentlich
Fisch	120	Portion	2	1	wöchentlich
Fleisch (Rind, Schwein, Geflügel) & Wurst	120	Portion	1	2	wöchentlich
Butter und Margarine	30	Scheibe	2	2	wöchentlich
	10	Esslöffel	1	1	täglich



HVALA NA PAŽNJI!

