

Resource Management Technologies

for Food Security and Sustainability

**R.K. Behl, Pravin Kumar Sharma
Arthur Riedacker & Gerhard Flachowsky**



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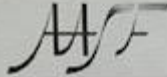


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VISION PAPER



1. Global Food Trends to Improve Human Health: 2025

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FOOD SECURITY 2025

A **Global Challenge** was outlined yearly more or less by the author (Kern 1996, 1998, 2000, 2001 a and b, 2002, 2004, 2006, 2007, 2010, 2011, 2014, 2015 a, 2015 b, 2016a,b, 2017, 2018 a, 2018, b, 2018 c, 2018 d, 2019, 2020a,b,c,d, 2021, 2023). A lead paper was presented in 2012 titled: **"Food Security at the Crossroads – A Wake up Call"** (Kern, 2012a, b).

A brief look back over the last 150 years and the outlook for the next 60 years, compressed into a time frame of 30 years each, was shown to provide an outline of conditions, backgrounds and intentions with respect to Article 25 of the Universal Declaration of Human Rights. A wake-up call and an action list was presented in order to improve food security (availability, accessibility, affordability, acceptability) as quickly as possible to realize Article 25 of the Human Rights Declaration.

The concluding remarks were the following: "Several future-oriented reports and recommendations for action which have been drawn up since the publication of Agenda 21 in 1992. They are concerned mainly with describing the major goals which have to be achieved. Basically, everything that needs to be done has been said, everything has been excellently described. The important thing, now more than ever, is to act immediately and more quickly than in 1992, knowing that the roads to be taken will be arduous and difficult.

Within this context the words expressed by *J. W. von Goethe* (1795/96) fit very well: "To act is easy, to think is hard, to act as one thinks is the most difficult."

We've done more than enough thinking, it's now 2012 and time to act! (Kern, 2012a, b) which is still valid in 2023.

Today "Food Security 2023" is not only a global challenge – it is a disaster - a real, but not a necessary catastrophe – a global failure of human mankind!

- ▶ Jean Ziegler, UN Special Report on the Right to Food from 2000 to 2008 has described the situation in 2015 by using drastic words: **"A child who dies of starvation is murdered!"**

"The United Nations (UN) bureaucrats are world champion in creating complicated statistics, mathematical models and several kilograms, often completely illegible reports in the official seven UN-languages. But when it comes to implementing specific measures to remedy the multiple tragedies afflicting the people of our planet, the UN remains mostly paralyzed."

- ▶ Berit Reiss-Andersen (Chair of the Norwegian Nobel Committee), 2020: **"Hunger is used as a weapon."**

The **Nobel Peace Prize 2020** was awarded to **World Food Programme (WFP)** "for its efforts to combat hunger, for its contribution to bettering conditions for peace in conflict-affected areas and for acting as a driving force in efforts to prevent the use of hunger as a weapon of war and conflict." In 2019, the WFP provided assistance to close to 100 million people in 88 countries who are victims of acute food insecurity and hunger.

- ▶ Development Minister of Germany Gerd Müller (2013-12/2021) was cited by Barth (11/2021): **"Hunger is murder!"** – **"Day by day 15.000 children are dying from hunger!"**

The greatest challenges are the fight against the **pandemic**, the **protection of the climate** and to create a **world without hunger**. "And here we have to do more and not less!" - **"Hunger is murder, because we have the technologies and the knowledge."**

His ministry investigated with international experts, how much money would be needed, that every child on the globe would have enough to eat. The result: With an additional \$US 40 billion per year, a world without hunger would be possible by 2030. "Why do we not do it? Because the political courage is missing!" said Müller.

Global Malnutrition: Predictions and Reality, 1974-2020-2030-2060 (2022), fig. 1-4:

- ▶ **Kern, 02/2007:** "Related to **higher food prices**, a lot of people will explain why the world will/could not reach the millennium target to halve hunger until 2015!"
- ▶ **Kern, 02/2017:** "Due to the **increase of conflicts** and due to **climate change**, a lot of people will explain, why the world will/could not reach 'Zero Hunger until 2030!'"
- ▶ **Kern, 2020 a, b:** "Due to the **corona pandemic**, a lot of people will explain, why the world will/could not reach "Zero Hunger until 2030!"
- ▶ **Kern, 02/2022:** "Due to the fact **politicians have not the courage** to eliminate hunger, a lot of people will explain, why it is not possible to eliminate hunger in years to come!"

Food Security 1864-2074: Hunger 2020 ... 2030

HUNGER

Source: Kern, M., 2022/2022

Dr. Manfred Kern



FIG. 1: Food Security 1864-2074: Hunger 2020 ... 2030

Global Malnutrition: Predictions and Reality, 1974 - 2020 - 2030 - 2060, 2022

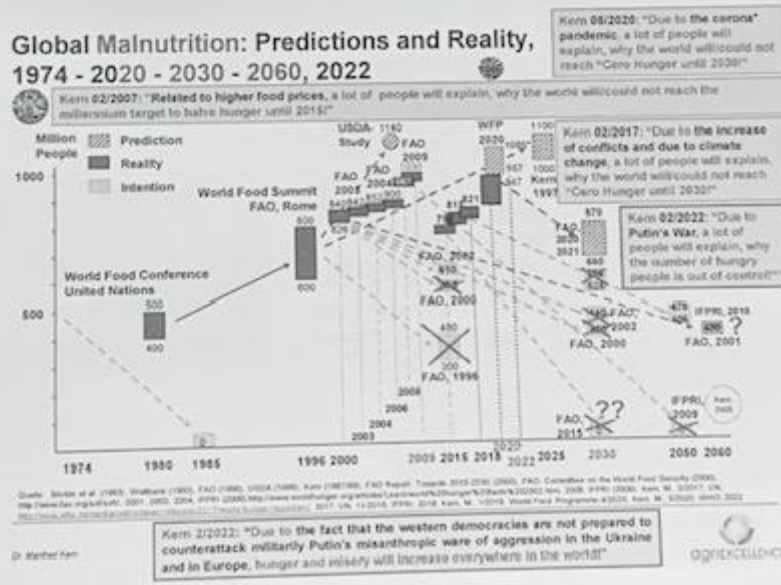


FIG. 2: Global Malnutrition: Predictions and Reality, 1974-2060, 2022

In October 2021, ADM outside Voice published the next big consumer trends – No.5 was **"Humanization of Pets"**.

"Pets are more commonly seen as part of the family – a trend that has been present over time but accelerated in strength during the pandemic. This extends to what their pets eat, with many pet parents transposing their purchasing values and preferences onto their furry companions. There's been a 41% increase in "all natural" pet foods launched globally. Likewise, ADM Outside VoiceSM also found that 30% of global pet owners spent a significant amount of time researching the best food options in the last year.

As consumers are challenged with changing lifestyles and a return to work, they will continue to monitor their pets' overall well-being to ensure they're providing foods and supplements aimed at helping them care for their minds and bodies."

Without being cynical, please have a look at the keynote lectures given by Kern (2012b,2017): "Hidden Hunger versus Impertinent Intemperance: Some Dogs and Cats Feed Gourmet-Quality – and a Lot of People Eat Dirt – An Eye-Opener – Not a Vision".

E.g., the CO₂-PawPrint of a dog in western countries is 30 times higher than the CO₂-Foot Print of a child living in Bangladesh (Kern, 2017).

Food for Thought, 2007, 2014/2017, 2022:

- "To save a dog will not safeguard the world, but it will change the world of the dog!"
(<http://futureofagriculture.com>) 2013
- "To save a child will not safeguard the world, but it will change the world of the child!"
(Kern, M., 2013)
- "Would it be nice, that suffering kids would get a little bit?"
Ad agency of Demner, Maršček & Bergmann, 2007)

© Michael Kern
 agriact

FIG. 3: Food for Thought, 2007, 2014/2017, 2022

Furthermore, some food for thought (Kern, 2020 a, b, c, d):

- ▶ Who only thinks about the future and does not master the present, will have no future?
- ▶ "Who thinks of the future and masters the present, only this one has a future!"
- ▶ i.e.: "The future is now!"

Akure with Her 4-Year-Old Daughter Ikeno and 2-Year-Old Son Lochuch, Who Are Trying to Suck the Marrow from Donkey Bones, 2017



©2017 World Vision
photo by Jon Warren

Source: <https://www.worldvision.org/our-work/child-protection/child-protection-2017>

© World Vision



FIG. 4: Food for Thought, 2017

Therefore, the priority setting of key global challenges has to be changed and must be the following:

- ▶ Tackle **COVID-19** pandemic,
- ▶ Eliminate hunger, and poverty
- ▶ Protect the climate and the environment!

The support of politicians, agencies, organizations working in the field combating hunger and poverty is essential from the public at large. Unfortunately, there are more or less, no people on the road demonstrating for the elimination of hunger and poverty – we see worldwide many demonstrations against vaccination, against climate change, against fossil energy, against discrimination, *etc.*, but more or less no one is demonstrating for eliminating hunger and poverty in the world. Most people are not concerned, look away and make themselves complicit in starvation of millions of people through the failure to provide assistance.

Furthermore, most people are not concerned, because they are not well informed about the inhumane life of millions of people living on earth. The actual CARE-Report "Suffering in Silence" (2021) shows that "during the last year the international Online-Media have reported 240.000 times about the space flights of Jeff Bezos and Elon Musk. The human crisis in Zambia, where 1.2 million people are suffering from hunger, found only 512 mentions. The adventures of these both billionaires were discussed almost 500 times as often than the hunger crisis in this South African country" (Care, 2022).

Worldwide, media must give urgently more focus to this inhuman disaster in order to increase pressure to decision makers. Otherwise, the globe will see more and more riots on the road, people fighting for food and a better future.

And the number, forecasted by Kern (1997), of 1.0-1.1 billion people suffering from hunger by 2025 will be unfortunately the harsh reality.

Actually, Corona-pandemic is shocking the globe and the food prices are highest since 2014. The pandemic deepens global hunger and the poorest of the poor are suffering most. Millions of people must stay at home, have lost their jobs, had no money or purchasing power and have no access to affordable healthy food. The agricultural food production system is very fragile and is changing day by day. There is a severe disruption of the food supply chains and is putting food out of reach for many people worldwide.

Well, The High-Level Panel of Experts of the Committee on World Food Security at FAO (9/2021) is still dreaming the dream to meet Sustainable Development Goal (SDG) 2: "**Zero Hunger**" documented in the introduction of their report on impact of COVID-19 on food security and nutrition. Nevertheless, the analysis of relevant factors and developments are important to guide actions in an appropriate way. The recommendations for policy shifts are a pretty good and worth reading. The focus is given to social protection programs, to protections for marginalized farmers, to countries depend on food imports, to the coordination of policy response to the COVID-19 pandemic impact, to resilient food distribution systems, to shorter supply chains, and to more resilient food production systems/agriculture.

Social protection programs have priority No. 1. Such programs need significantly more therapeutic foods, foods which are designed for specific, usually nutritional, therapeutic purposes as a form of dietary supplement. The primary examples of therapeutic foods are used for emergency feeding of malnourished children or to supplement the diets of persons with special nutrition requirements, such as the elderly. Therapeutic foods, ready-to-use therapeutic foods (RUTFs), are energy-dense, micronutrient-enriched pastes and without the need for expensive packaging.

In April 2020, Beasley (WFP) was warning of an upcoming 'hunger pandemic' and that the international community was short in providing the necessary assistance needed during the pandemic (Khorsandi, 4/2020).

Therapeutic food stocks must be enlarged to provide food aid for people living in camps, ghettos, refugees, migrants, war zones, or fallen states. Triggered by COVID-19 pandemic the number of hungry people will increase dramatically in years to come.

In November 2021 FAO was warning that 3 billion people worldwide are currently unable to afford a healthy diet (Green, 2021). Well, even before the COVID-19 pandemic, the world was not on track to eliminate hunger and malnutrition by 2030.

In December 2021 FAO published that the FAO Food Price Index (FFPI) averaged 134.4 points in the month, its highest level since June 2011. The index, which tracks monthly changes in the international prices of commonly-traded food commodities, was 27.3% higher than its level November 2020. Furthermore, that global food trade increased by 14% from the previous year 2020, the import bill of developing countries increased by 20%, and the Global Input Price Index (GIPI), the prices of energy, fertilizers, pesticides, feed, and seed increased overall by 25% (Selby, 11/2021).

All this are clear indicators for the increase of riots, conflicts, revolutions, violence, wars, and refugees in the years to come. Peace will be put at risk in many regions of the world. Well, food security is a key prerequisite for peacekeeping!

Furthermore, it has to be considered:

- ▶ That between 2015 and 2050 more than a doubling of crop production, a nearby doubling of meat production, a tripling of plant-based protein production (food & feed), and a tripling of fruit and vegetable production is necessary to feed 9.7 billion people living on earth in a healthy way (Kern, 2016a, b).

- ▶ That climate change and other “*black swans*” will make agriculture increasingly volatile.

Definitions for clarification

- ▶ ‘**Food**’, is any substance consisting essentially of protein, carbohydrate, fat, vitamins or minerals used in the body of an organism to sustain growth and vital processes and to furnish energy (Merriam Webster’s Dictionary, 2019).
- ▶ ‘**Food**’ (or ‘**Foodstuff**’) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans (EC Regulation No 178/2002 of the European Parliament and of the Council, January 28, 2002).
- ▶ ‘**Functional Food**’/‘**Nutraceutical**’ is food, containing additives, which provide extra nutritional value, but often not supported by sufficient scientific evidence (Wikipedia, 2022).
- ▶ ‘**Pharma-Food**’ is a product with pharmacological additive meant to improve health, for example to lower cholesterol (Conrad-Stöppler, 2021).
- ▶ ‘**Bio-Pharmacy**’ are medical substances that a produced with means of biotechnology and genetically modified organisms.
- ▶ ‘**Medical Food**’ is specially formulated, medically evaluated and intended for the dietary management of a disease that has distinctive nutritional needs that cannot be met by normal diet alone. Consumption is under the supervision of a physician.
- ▶ ‘**Food as Medicine**’ interventions advance health equity by transforming the healthcare system’s role to increase access to, and utilization of, the best available, affordable food to improve the overall health of communities (Alameda County Board, 2019).
- ▶ ‘**Nano-Food**’ is foods that contains nano-materials or involve nanotechnology in their processing.
- ▶ ‘**Personalized Medicine**’ is also referred to as precision medicine - is a medical model that separates people into different groups – with medical decisions, practices, interventions and/or products being tailored to the individual patient based on their predicted response or risk of disease. Is selecting appropriate and optimal therapies based on the context of a patient’s genetic content or other molecular or cellular analysis (Wikipedia, 2022).
- ▶ ‘**Drug**’ is any natural or artificially made chemical that is used as a medicine,
- ▶ ‘**Nutrition**’ is the process of taking in food and using it for growth, metabolism, and repair.
- ▶ ‘**Personalized Nutrition**’ is not finally defined, but in simple words, it is a tailored nutritional recommendation that promotes and maintains an individual’s health and helps to fight against existing diseases (Princy, 2021). It uses individual-specific information, is founded on evidence-based science, and has the goal to give consumers control and promote a positive, sustainable dietary behavioural change (Foodvalley, 2021).
- ▶ ‘**Wholesome Nutrition**’ is one important way consumers are looking to support their holistic well-being (balance of diet and lifestyle, mental well-being, coping with stress and anxiety) (ADM Outside Voice, 10/2021).
- ▶ ‘**Diet**’ is an eating plan in which someone eats less food, or only particular types of food, because they want to become thinner or for medical reasons (Cambridge Dictionary, 2021).
- ▶ ‘**Dietary Supplements**’ are defined by law as products taken by mouth that contain a ‘dietary ingredient’. Dietary ingredients include vitamins, minerals,

amino acids, and herbs or botanicals, as well as other substances that can be used to supplement the diet. They are not intended to treat, diagnose, cure, or alleviate the effects of diseases (US Food & Drug Administration, 2015).

- ▶ **'Therapeutic Diet'** is an adopted way of eating to improve or enhance the nutrition and health, typically under a dietician or physician's guidance (Hugh, 2021).
- ▶ **'Eating'** means to consume food, to express lifestyle, social gathering, and culture.

Plant-based protein – An alternative for meat!?

In an interdisciplinary vision paper titled: *"Meat Alternatives (Plant-Based Meat) Will Plow up Agriculture in the Future by 2025/2050!?"*, written by Kern (2021) the following conclusions were presented:

It can be assumed that in 2020 nearby 200 different meat-alternative products did come onto the global market mainly to replace meat burgers based on ground meat. However, step by step, consumers will see more variety of options. They will get hundreds of plant-based sausages, 'schnitzel', lasagna, BBQ ribs, nuggets, boulettes, kebabs, crumbles for tacos, burritos, breakfast items, and pizza toppings. Taste, nutrition, acceptable ingredients, functional ingredients, and sustainability are key factors for this new food segment. Consumers are focusing on functional and real ingredients, all natural, made fresh, no additives, no artificial colours and 'whole grains' (Kerry Proprietary Consumer Research, 2019a, b).

Selected Books: "Plant-Powered Protein", 2019- 2021



FIG. 5: Selected books on "Plant-Powered Protein", 2019- 2021

Selected Books: "Plant-Based Meat", 2019-2021



FIG. 6: Selected Books on "Plant-Based Meat", 2019-2021

Fa. Handtmann: "Meat Innovation", IFFA, Frankfurt, 5/2019
"Hybride Sausages" – Meat & Plant Power



FIG. 7: Fa. Handtmann: "Meat Innovation", IFFA, Frankfurt, 5/2019 "Hybride Sausages" – Meat & Plant Power

FutureFarm, "Plant-Based Protein", Brazil, 2022



FIG. 8: FutureFarm, "Plant-Based Protein", Brazil, 2022

Many companies have developed new dedicated plant-based brand lines offering a broad spectrum of new foods. For example, Unilever: *'The Vegetarian Butcher'*, Nestlé: *'Garden of Eatin''*, Rügenwalder Mühle: *'Veggies'*, Marks & Spencer: *'Plant Kitchen'*, Kerry Inc.: *'Radicle'*, the first online shop in Europe Eureka: *'Future Food'*, and Kroger: *'Simple Truth'* or in Brazil: Future Farm: *'Future Mince'*, *'Future Burger'* and *'Future Sausage'*.

Furthermore, for many big producing companies, alternative meat is about 'and', and not 'or', because alternative protein could someday be a multi-billion business for them.

This upcoming new food production sector based on cellular or plant-based protein has the potential to upend a lot in the meat production business (fig. 5-8).

Cellular food / cellular meat

After 125 years, the visions/dreams of the famous chemist **Professor Marcellin Berthelot** about *"Foods in the Year 2000"*, that synthesized food will displace agriculture published in 1894 (Dam, 9/1894) seems to be on the way to be realized. However, options are not coming exclusively from chemistry, but more and more from biology and biotechnology.

"Cellular agriculture", "labriculture", and "integriculture" are new word creations based on new production technologies named: "in vitro meat", "cellular meat", "cell-based meat", "cell-cultured meat", "cultured meat", "fermented meat", "animal-free meat", "slaughter-free meat", "cruelty-free meat", "resource-efficient meat", "ethical meat", "artificial meat", "synthetic meat", "lab grown meat", "home cultured meat", "zombie meat", "blood-free meat", "imitated meat", "simulated meat", "faux-meat", "non-meat", "methane-based meat", "processed meat", "reinvented meat", "beyond meat", "fake meat", "Franken burger 'Shmeat'" or "clean meat" etc.

In a report published in 5/2019 by the consulting company ATKearney titled: "How Will **Cultured Meat and Meat Alternatives** Disrupt the Agricultural and Food Industry?" it is concluded, that "Meat Alternatives" are going to disrupt the \$1,000 billion conventional meat industry with all its supplier companies. The report claims, that by 2040, 35% of global meat consumption will be come from cultured meat, and 25% from vegan meat replacements.

Beginning 2022, the Ministry of Agriculture and Rural Affairs in China has included 'cultivated meat' and other foods like 'plant-based eggs' as part of their 5-year plan and food security strategy.

Fair regulations and an appropriate labelling of "**Meat Alternatives**" will be fundamental for the growth of the new industry. Key parameters for the future market of "**Meat Alternatives**" among other are the following ones: Quality, taste, flavour, texture, convenience, price, profitability, target groups in markets, affordability, availability, nature based vs science based, GMO-debate, natural vs artificial, nutritional profile, long-lasting impact on human health, food safety, fair regulations, appropriate labelling, progress in personalized nutrition (Kern, 1/2007), general benefits (health, environment, animal welfare), CO₂ footprint, use of non-fossil energy, bio-based product manufacturing, sustainable utilization of resources, transparency, consumer acceptance, consumer preferences, consumer demand, changing eating habits, respecting religions and cultural levels, social consensus, reactions of the livestock industry, improvements in animal production, innovations in agriculture (Grieve, B.D. et al. 5/2019), education, information, media and social media reflections, fake news, image creation, visibility, etc.

Organ specific food recommendations

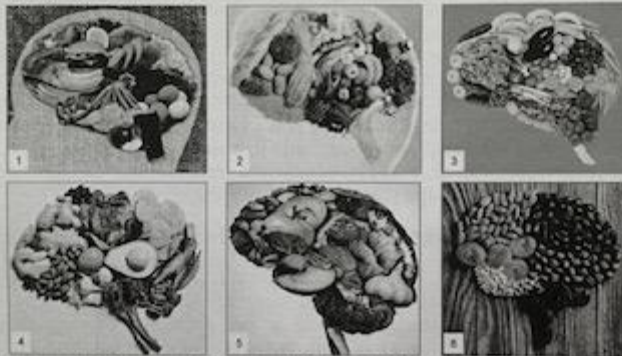
- ▶ "**The End of Heart Disease: The Eat to Live Plan to Prevent and Reverse Heart Disease (Eat for Life)**" by eliminating high-glycemic food, such as sugar, refined carbohydrates and white bread, by eating a "**full rainbow**" of vegetables and an abundance of healthy fats, as in fish, nuts, native olive oil, and avocados. Furthermore, by reducing animal products as much as possible, no more than three serving of animal products per week would be ideal (Fuhrman, 2018).
- ▶ "**Chemical in Veggies Help Heal Fatty Liver**" describes indole effects on fatty liver recommending cabbage, kale, broccoli, and cauliflower, as well as all cruciferous vegetables (Thomas, 2020). "Foods that Promote Liver Health", "Preventing and Controlling **Non-Alcoholic Fatty Liver Disease**" recommends minimally processed foods that are naturally high in nutrients and naturally low in fat, salt, and sugar, like vegetables, fruits, whole grains, and legumes (beans) (Killoran, 2021).
- ▶ "**Prostate Diet: 5 Foods You Should Eat every Day for a Healthy Prostate**", focuses on pears, cinnamon, oats, soya milk and pomegranates (Slade, 2021). The author mentioned that: "There aren't any foods that could 'cure' prostate cancer (or any cancer, for that matter), but there are many foods linked to better overall health and a healthier prostate.
- ▶ "**Best Foods that People with Kidney Disease Can Consume**" are cauliflower, red grapes, egg whites, garlic, olive oil, cabbage, skinless chicken, bell peppers, onions, Macadamia nuts, radish, turnips, pineapple, cranberries, and Shiitake mushrooms (Mulla, 2020). But the author outlines: "Every individual with kidney disease is different, which is the reason it's imperative to converse with your doctor and dietician about your individual dietary needs."
- ▶ "**Natural Foods for Clean and Healthy Lungs**" (Ushassu, 2021). In India, for detoxification and improvement of **lung health**, 56 natural foods (almonds,

anchovies, ..., barley, ..., broccoli, ..., honey, ..., mackerel, ..., olive oil, ..., pumpkin, ... tomatoes, ..., and yogurt) are listed to boost your lungs. However, cruciferous should be limited if you are suffering from gastric problems.

- ▶ **"Poster Food for Thought"** - These foods provide nutrients for *brain health*, improving memory, and boosting cognitive ability: "Eat smart, be smart!", (K12 posters, 2022).

The six "Brain Food"-illustrations (fig. 9, 10) selected as examples demonstrate a wide variety, heterogeneity and diversity of the so called "Brain Food". Information is usually very generalizing and sweeping, generally placed in a functional relation to the brain and not personalized at all. A scientific relevance is often only derived or partially made plausible, but validated data from broad medical studies are mostly missing in such cookbooks.

Six Selected Books: "Brain Food", !?... 2021



Source: 1 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021; 2 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021; 3 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021; 4 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021; 5 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021; 6 <https://www.istock.com/stock-photo/brain-food-illustration>, 2021

© Shutterstock.com



FIG. 9: Six Selected Books: "Brain Food", !?... 2021

- ▶ **"Nutrition: Better Brain Function by Food Additives?"**, Food additives are no panacea. There are more than 25.000 bioactive ingredients in our food, which are interacting to protect our body, including the brain und relevant processes, which are influencing brain function. However, the uptake of one or only two ingredients is not a panacea" (Stindt, 2021).

Karpathiou (2021) raised and answered the question: **"Let Food be thy Medicine"** Do Hippocrates Famous Words Still Apply in the Modern, Covid-era? very well like that: "At a time when the prevalence of eating disorders continues to rise (all made worse due to Covid lockdowns) within a society that concurrently continues to place hope in false claims of happiness and freedom through the latest greatest fad diet and 'new age eating ways', the message that 'using food to heal and restore' and that 'food is the best form of medicine' has become distorted and messy.

Selected Books: "Nutraceuticals for Brains", 2022



Source: Kim, M., 2022.

Dr. Maribel Kim



FIG. 10: Selected Books: "Nutraceuticals for Brains", 2022

- ▶ People no longer know what that means. You just have to go onto Instagram and see the myriads of 'health coaches' that promise to heal your ailments with some supplement or diet.
- ▶ The truth of the matter is (and don't get scandalized) is that all foods including carbohydrates of all types, protein of all types, and fats of all types of acts in unison as a 'support system' for the body.
- ▶ This support system plays a major role in healing and sustaining our physical bodies and minds."

Beside this, it has to be considered, that even the same meal eaten by the same person at a different time of the day can be metabolized differently depending on the lifestyle of a person. Furthermore, food of one person can be the poison of another (e.g., gluten sensitivity).

A Google-research made beginning 2022 is showing that a great number of different plants are described or recommended to fight cancer (fig. 11). The question would be: "Which food to fight cancer is recommended most?"

Well, after analyzing the first 20 recommendations, whereby 210 plants were addressed, the following ranking concerning anti-cancer foods can be made: broccoli (17), berries (14), garlic (11), tomatoes (10), nuts (9), apples, beans, turmeric, tea (8), citrus (7), carrots, whole grains (6), soybeans, dark green vegetables, mushrooms, flaxseed, grape fruit (4) and grapes, sweet potato (3), plus fatty fish (Salmon) (6).

A new book could be written titled: "**Top 20 Hyper foods Fight Cancer!**"

Google-Recherche: "Foods Fight Cancer", 1/2022

1. "1 No single food can protect you against cancer by itself."
2. "2 top anti-cancer food"
3. "3 ways to spot a cancer-fighting food."
4. "4 cancer-fighting foods to eat."
5. "5 food that fights cancer."
6. "6 cancer fighting foods."
7. "7 best cancer-fighting foods to add to your diet."
8. "8 top cancer-fighting foods."
9. "9 best fruits to eat during cancer treatment."
10. "10 foods that fight cancer."
11. "11 foods that help in preventing cancer."
12. "12 foods that shrink benign tumors."
13. "13 foods that could lower your risk of cancer."
14. "14 foods that will fight cancer for you."
15. "15 great anti-cancer foods."
16. "16 top cancer-fighting foods."
17. "17 foods that prevent breast cancer."
18. "18 foods to lower your cancer risk."
19. "19 foods to fight cancer"
20. "20 cancer fighting foods that naturally protect you."
21. "21 foods that help you prevent cancer."
22. "22 Cancer-fighting foods you should eat often."
23. "23 best foods that will lower your risk of cancer."
24. "24 cancer fighting foods to heal naturally."
25. "25 anti-cancer foods."
26. "26 anti-cancer foods."
27. "27 best cancer prevention nutrition."
28. "28 foods that may help prevent cancer."
29. "29 foods that may help prevent cancer."
30. "30 cancer-fighting foods that reduce your disease risk."
31. "31 powerful herbs and supplements for treating and preventing cancer."
32. "32 antioxidant food for anti-cancer."
33. "33 foods that starve cancer"
34. "34 top anti cancer foods."
35. "35+ super foods to reduce cancer risk, fight cancer."
36. "36 foods that may help lower your cancer risk."
37. "39 delicious foods that are linked to a lower risk of cancer"
38. "40 foods that fight cancer."
39. "50 foods that fight cancer."
40. "92 alkaline foods that can fight cancer, inflammation, diabetes and heart disease."

Which food to fight cancer is recommended most?

Answering this, a new book could be written titled: "Hyperfoods Fight Cancer"!

Source: Yarn, M. (2022)

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FIG. 11: Google-Recherche: "Foods Fight Cancer", 1/2022

Visual Summary of CBMs (Cancer-Beating Molecules) Associated with Strong Anti-Cancer Likeness, 2019



- The contained profiles of compounds within selective foods, which were highly likely to be effective in fighting cancer.
- Each node in the figure denotes a particular food item and node size in each case is proportional to the number of CBMs.
- The link between nodes reflects the pairwise correlation profile of CBMs in foods, thus the clusters of foods illustrate molecular commonality between them.
- The foods that show greatest diversity in CBMs include tea, grape, carrot, coriander, sweet orange, dill, cabbage and wild celery.

Source: Veenker, K. et al. (2019) *Food Chemistry* 289: 1-10. DOI: 10.1016/j.foodchem.2019.03.038

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FIG. 12: Visual Summary of CBMs (Cancer-Beating Molecules) Associated with Strong Anti-Cancer Likeness, 2019

A more scientific approach to clarify the impact of cancer-beating substances of foods is done by Veselkov *et al.* (2019) (fig. 12). Within 7962 bioactive molecules, which can be found in foods, 110 cancer-beating molecules were found with expected capacity, comparable to clinically approved anti-cancer drugs from a variety of chemical classes such as flavonoids, terpenoids, and polyphenols. The analysis underpins the design of next generation of cancer preventive and therapeutic nutrition strategies.

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