



Effect of processing on the nutritional quality of food

R Govindarajan

CIO, Adret retail Ltd (Kapiva)

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Ultra-processed, fast food leading cause of diabetes in India: study

Bindu Shajan Perappadan
NEW DELHI

A diet rich in “advanced glycation end products (AGEs)”, which includes ultra-processed and fast food, is among the leading cause of India being the world’s diabetic capital, notes a first-of-its-kind clinical trial finding published in the *International Journal of Food Sciences and Nutrition* recently.

AGEs are harmful compounds that are formed when sugars react with fats or proteins during high-temperature cooking, such as frying and roasting. They are directly linked to inflammation, a key factor behind diabetes.

The study was funded by the Department of Biotechnology, Ministry of Science and Technology.

The study found that low-AGE diets exhibited improvement in the insulin-sensitivity and reduc-



Having AGE-rich foods leads to inflammation in the body, says the study. GETTY IMAGES

tion in the inflammatory levels compared to high-AGE diets. “The study revealed that low AGE diets could be a potential strategy to reduce diabetes risk,” it said.

Prevalence of diabetes, pre-diabetes, and obesity is on the rise globally, and in Asian Indians, there are currently 101 million individuals with diabetes. Earlier studies in the West have demonstrated an increased risk of chronic diseases due to the consumption of processed foods

that are high in fat, sugar, salt, and AGEs.

The current study shows that the consumption of AGE-rich foods leads to inflammation in the body. “This is because glycation – a non-enzymatic chemical process in which a sugar molecule binds to a protein or lipid molecule – can result in harmful reactions in the body,” notes the study.

It recommends that by following a low-AGE diet (fruits, vegetables, whole grains, and low-fat milk), overweight and obese individuals can reduce oxidative stress in their bodies, which refers to the imbalance of free radicals and antioxidants that results in inflammation and cell damage.

As part of the clinical trial, adults who are either overweight or obese but non-diabetic were divided into two groups. While one group was given a low-AGE

diet for 12 weeks, the other was put on a high-AGE diet. At the end of 12 weeks, the researchers found that insulin sensitivity was significantly increased in the low-AGE diet group, compared with the high-AGE diet group. The low-AGE diet group also showed lowered risk of future type 2 diabetes.

Dr. V. Mohan, chairman, Madras Diabetes Research Foundation, which carried out the study, said, “By adopting healthier diets such as green leafy non-starchy vegetables, fruits, boiled foods rather than fried ones and cutting down on bakery foods and sugary foods, one can have diets which are low in dietary AGEs and thus lower the risk of type 2 diabetes.”

Dr. Mookambika Ramya Bai, the first author of the study, said, “It means going back to the healthier diets that our forefathers ate.”

3 scientists share Chemistry Nobel

STOCKHOLM, AP/PTI

The Nobel Prize in chemistry was awarded on Wednesday to three scientists for their breakthrough work predicting and even designing the structure of proteins, the building blocks of life.

The prize was awarded to David Baker, who works at the University of Washington in Seattle, and to Demis Hassabis and John Jumper, who both work at Google DeepMind, a British-American artificial intelligence research laboratory based in London.

Heiner Linke, Chair of the Nobel Committee for Chemistry, said the award honoured



David Baker



Hassabis



John Jumper

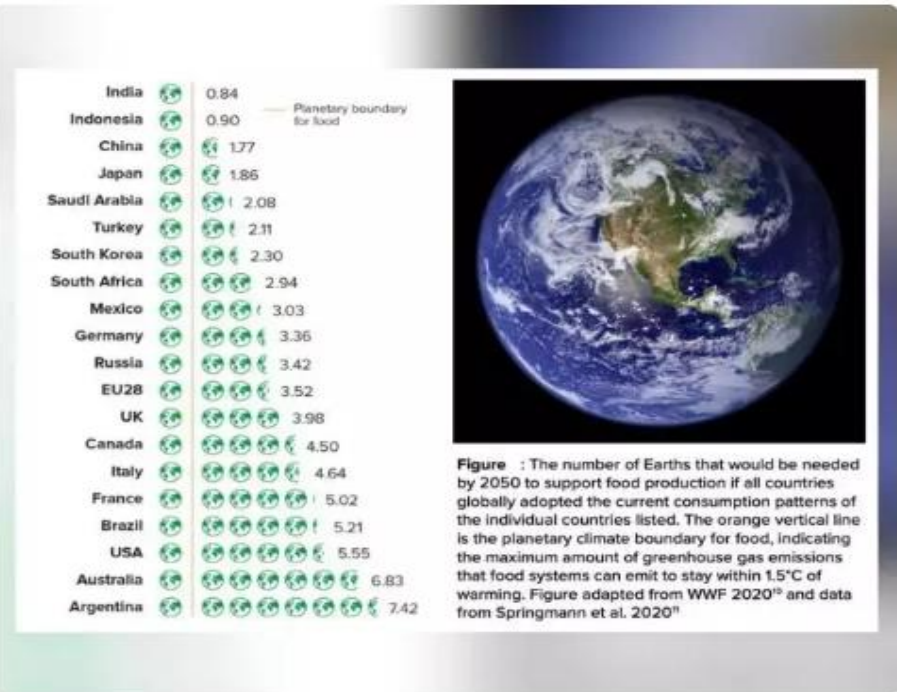
research that made connections between amino acid sequence and protein structure. Baker designed a new protein in 2003 and his research group has since produced one imaginative protein creation after another,

including proteins that can be used as pharmaceuticals, vaccines, nanomaterials and tiny sensors, the Nobel committee said.

“The number of designs that they have produced and published, and the variety, is absolutely mind blowing. It seems that you can almost construct any type of protein now with this technology,” said Professor Johan Åqvist of the Nobel committee.

Hassabis and Jumper created an artificial intelligence model that has been able to predict the structure of virtually all the 200 million proteins that researchers have identified, the committee added.

Food consumption



India's food consumption pattern best for Earth: Living Planet Report

short by Ankush Verma / 04:26 pm on Thursday 10 October, 2024

The World Wide Fund for Nature (WWF) has recognised India's food consumption pattern as the best for Earth in its latest Living Planet Report. If all countries adopted India's consumption pattern, the world would require less than one Earth to sustain food needs, as per the report. Countries like Argentina, Australia and US were identified as having least sustainable patterns.

read more at WWF

- Moderation is not just for processed food but all food that is consumed.
- physical activity levels are depleting, our lifestyle needs major change.
- WHO themselves technology in agriculture and easy availability of foodstuffs as triggers for sedentary lifestyle, but have lopsided focus only on packaged foods & beverages.

inshorts.com/en/news/india-s-food-consumption-pattern-best-for-earth--living-planet-report-1728557785575?utm_source=news_share

Introduction

- Brief overview of food processing

- transforming raw ingredients into consumable products through various techniques
- includes mechanical processes like chopping, grinding, thermal processes like cooking and pasteurization, and preservation methods such as freezing, drying, and canning
- goals are to enhance shelf life, improve safety, and increase convenience while often adding nutritional value or flavor.
- It plays a crucial role in the food supply chain, making food more accessible and affordable for consumers.
- However, it also raises concerns about nutritional quality, additives, and environmental impacts



"Mmm, processed food. Just like mom used to microwave."

Introduction (contd.)

- Importance of nutritional quality in diet
 - Health Maintenance
 - Weight Management
 - Energy Levels
 - Mental Health
 - Preventing Nutritional Deficiencies
 - Digestive Health
 - Long-term Wellness



"Tasty *and* nutritious? Any five year old knows *that's* a contradiction in terms."

- In summary, focusing on the nutritional quality of your diet is crucial for physical, mental, and emotional health, paving the way for a healthier life

Food Processing

- **Primary Processing:** Cleaning, sorting, drying
- **Secondary Processing:** Cooking, canning, freezing
- **Tertiary Processing:** Refining, fortification, additive use



But how do you KNOW if it's ultra processed food?



"THE NUMBER INDICATES HOW CLOSE IT COMES TO REAL FOOD."

Evolution of food processing

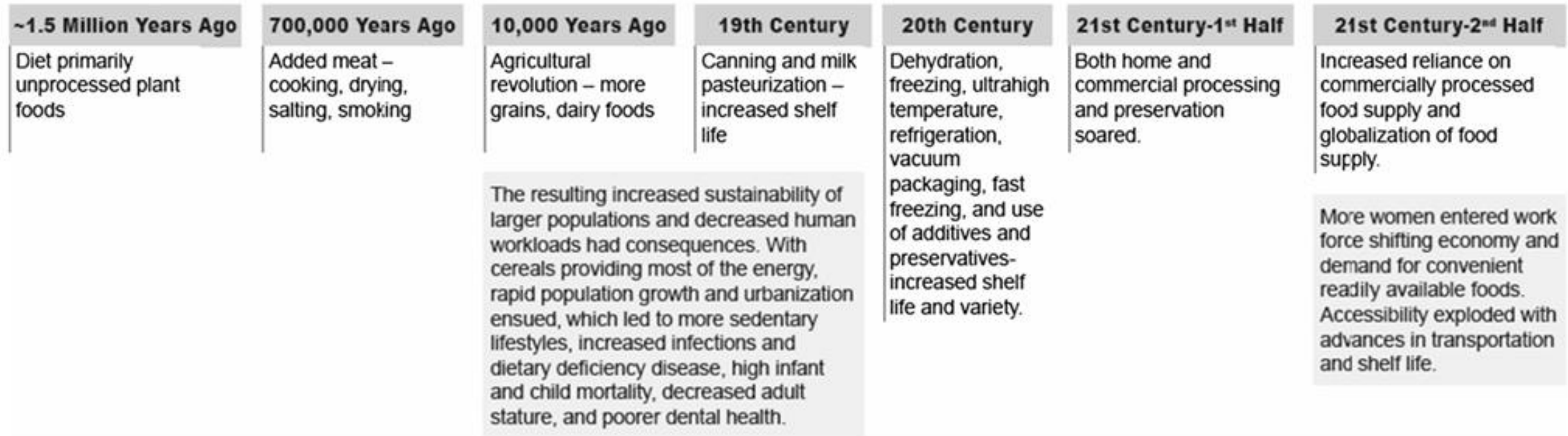


FIGURE 1. Evolution of food processing.

Common processes...

- Mechanical Processing
- Thermal Processing
- Fermentation
- Dehydration
- Freezing
- Canning
- Pickling
- Emulsification
- Extrusion
- Additive Processing

Each type of processing serves different purposes, from preservation and safety to enhancing flavor and convenience.



Nutritional Changes During Processing

- **Loss of Nutrients:** Vitamins (e.g., vitamin C in fruits), minerals (e.g., potassium in vegetables)
- **Bioavailability:** Changes in the body's ability to absorb nutrients



Positive Effects of Processing

- Food safety and Quality:
 - Inactivation of food borne pathogens/ natural toxins, enzymes
 - Removal of pesticides & toxins
 - Shelf life prolongation/ less likely to deteriorate
 - Easing food shortages/ shipped to long distances/ kept longer
- Nutrition and Health
 - Inactivation of anti-nutritional factors
 - Denaturation of proteins/ gelatinization of starches – improves digestibility
 - Fortification
 - Health benefits – pro and prebiotics, allergen removal, flavonoids etc
- Sensory
- Environment
- Affordability
- Convenience
- Job creation



"Processed food was his undoing. He was eating a salad sandwich in the warehouse, when a pallet of pork pies fell on him!"

CX902414



"These are the scientists behind some of your favorite preservatives."

Negative Effects of Processing

- **Nutrient Loss:** Some vitamins (like vitamin C and B vitamins) can degrade during processing, especially with high heat or prolonged exposure to light.
- **Formation of undesired compounds** – acrylamide, acrolein, heterocyclic amines etc
- **Additives and Preservatives:** contain added sugars, sodium, and unhealthy fats, which can detract from overall nutritional quality.
- **Loss of Fiber:** Refining grains removes bran and germ, leading to lower fiber content and associated health benefits.
- **Altered Nutrient Profiles:** lower nutritional density, the natural balance of nutrients, potentially leading to imbalances (e.g., higher glycemic index in refined carbohydrates).
- Can become expensive
- Increased intake of energy dense foods
- Lowering salt and sugar may compromise on microbial load
- Loss of original color/ texture



"We don't know what it is, but once we add bacon, the public will love it."



Do you remember when food had food in it?

Mitigation

- Optimize process condition eg time and condition
- Adding back lost nutrients – fortification
- Portion sizing
- Formulate with low environmental impact
- Recyclable packaging
- Enforce safety standards in factory

Some key changes

- **Vitamin Loss:**
 - **Heat:** Cooking methods like boiling and frying can degrade heat-sensitive vitamins (e.g., vitamin C and some B vitamins).
 - **Light and Air:** Exposure to light and oxygen can lead to nutrient degradation, particularly in fruits and vegetables.
- **Mineral Retention:** Minerals are generally stable during processing, but some methods (like boiling) can result in leaching into cooking water, which is often discarded.
- **Fiber Content:** Processing can reduce fiber content, especially in refined grains. Whole grains retain their bran and germ, while white flour loses many fiber-rich components.
- **Fat Changes:** The type of fat used in processing (e.g., trans fats in partially hydrogenated oils) can impact the healthfulness of the final product.
- **Protein Quality:** Some processing methods can alter the protein structure, potentially affecting digestibility and bioavailability. For example, fermentation can enhance the digestibility of proteins.
- **Antioxidant Levels:** Processing can reduce antioxidant levels in some foods, although certain methods (like fermentation) can enhance the bioavailability of antioxidants.
- **Additives**
- **Glycemic Index:** Processing can change the glycemic index of foods. For example, whole grains have a lower glycemic index compared to refined grains,
- **Fortification:** Some processed foods are fortified with vitamins and minerals to enhance nutritional quality, such as adding calcium to orange juice or vitamin D to milk.
- **Loss of Phytochemicals:** Processing can reduce the levels of beneficial plant compounds (phytochemicals) found in whole foods, which contribute to health benefits.

Understanding these changes is crucial for making informed dietary choices, emphasizing the importance of selecting minimally processed foods when possible.

Examples of current and future food processing technology innovations and their benefits to consumers

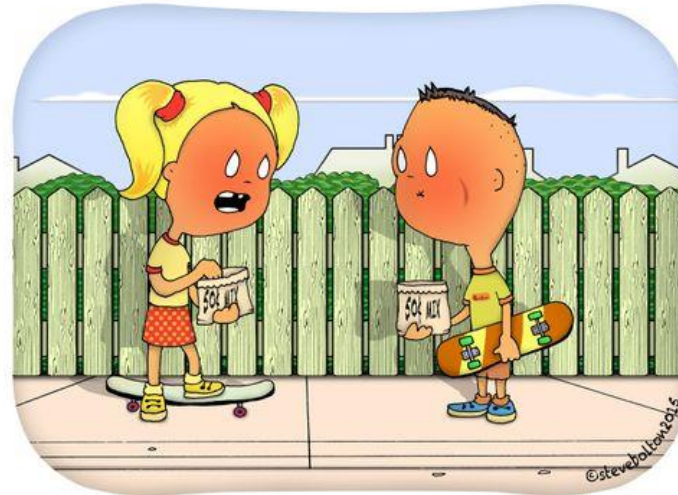
Challenge	Innovative technology	Consumer benefits
Reduce calorie intake	Digestion-resistant starches <ul style="list-style-type: none"> • Changing starch structures in plants • Modifying starch chemistry Naturally derived noncaloric sweeteners Fat-reduction processes for food preparation	Reduce risk of obesity, diabetes, and related morbidities while maintaining diverse and enjoyable diet
Enhance gut health	Novel types of fiber such as water-soluble Development of prebiotics and probiotics and effective biodelivery systems	Optimize digestive tract performance and reduce risk of disease; resist allergens; enhance well-being
Reduce salt intake	Altered salt crystal structures such as microcrystallization Flavor enhancement approaches to replace salt	Provide flavor and food quality while reducing excessive salt intake
Enhance health benefits of foods	Stabilized omega-3 fatty acids and DHA enrichment of foods Targeted biodelivery with the use of nanotechnology of antioxidants and other bioactive compounds Natural colors and flavors derived from plants	Improved dietary quality with enhanced nutrients and bioactive compounds that enhance health and well-being and prevent disease
Improve food safety and reduce food waste	Smart packaging materials Temperature and oxygen sensors Natural antimicrobials Edible packaging	Better information about food handling and safety; means of readily identifying unsafe foods; reduced handling to avoid contamination; reduced landfill waste
Reduce allergy	Nanotechnology approaches to block antigenic agents Plant modifications to reduce antigen exposure	Prevention of allergic responses to foods to enhance quality of life
Promote fresh but stable foods	Nonthermal processing: high-pressure processing, ionizing radiation, pulsed electric field Advanced packaging techniques Improved plant varieties	Access to fresh, high-quality foods year-round at affordable prices to promote enhanced consumption and improve nutrition
Produce age-specific products	Optimize nutrients for <ul style="list-style-type: none"> • Infants • Children • Pregnancy • Athletes • Midlife • Older adults 	Improve growth and development; enhance mental acuity; prevent or treat disease; improve fitness and well-being; prolong quality of life

Case Studies

- **Frozen vs. Fresh Vegetables:** Nutrient retention comparison
- **Canned vs. Fresh Fruits:** Impact of canning on nutrient levels



"Of course, the carrots are fresh. See... they still have dirt on them."



"If a fruit doesn't have a sweets flavour, is it a real fruit?"



Shall I put the strawberry in now?

Consumer Awareness

- Importance of reading labels
- Understanding processing methods



Conclusion

- While processing can enhance safety and convenience, it's important to consider its effects on nutritional quality. Opting for minimally processed foods can help maintain a healthier diet



PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

Consumer understanding of the term 'ultra-processed' may be low, but does it really matter in the larger scheme of things?

While there is a lack of consensus on what exactly constitutes ultra-processed foods, the term has been linked to negative health outcomes by organizations such as the World Health Organisation.

On one hand, there is a need for consumers to be more educated about the foods they are consuming and the potential health implications of ultra-processed foods. However, there is also a need for a more nuanced understanding of what constitutes a healthy diet, beyond simply avoiding UPFs. While the Nova classification

may be a helpful guideline, it is important for consumers to consider factors such as nutrient density and overall diet quality when making food choices.

Additionally, alternative categories such as HFSS may provide a more comprehensive approach to identifying 'unhealthy' foods, taking into account both negative and positive nutrients.

Ultimately, a more informed and holistic approach to food



choices is crucial for promoting better health outcomes for individuals and communities.
<https://www.foodnavigator.com/Article/2024/06/17/Ultra-processed-misunderstood-by-consumers-Does-it-matter>

Thanks