Food waste solutions at household: basic principles

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Abstract: Urgency to act

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Why Food waste? Urgency to act

NOW → FUTURE

Food waste worldwide

UN says problem on all continents irrespective of income level

WORLD FOOD CONSUMPTION

17% is wasted

SHARE OF 931 MILLION TONNES OF GLOBAL FOOD WASTE PER YEAR

Households 61%

Food service 26%

Retail 13%

Household food waste estimate
(kg/capita/year)

● 189 ● 100 ● 50 · 20

Countries not included due to low or very low confidence in estimate or no data

Source: UNEP

AFP ●

Crop production (trillion calories per year)

25,000

20,000

15,000

10,000

5,000

0

56% FOOD GAP

13,100 TRILLION CALORIES

20,500 TRILLION CALORIES

2010 (Base year)   2050 (Baseline)

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VIRTUAL WATER *inside products*

Value	Product
450	Corn
500	Wheat
1700	Rice
900	Soybeans
70	Apple
50	Orange
2500	Coconut
2500	Cheese
650	Toast
90	Tea
840	Coffee
720	Wine
150	Beer
185	Potatocrisps
1000	Milk
4500	Beef
1200	Goatmeat
1440	Pork
1830	Sheepmeat
1170	Chicken

Food life-cycle
- Agricultural production
- Post harvest handling and storage
- Processing
- Distribution
- Consumption
- End of life

Losses and waste during consumption at the household level

Biodiversity

Economic cost

EMITTING CARBON

10,000 TONS ORGANIC WASTE IN LANDFILL = 6,639 CARS ON THE ROAD

10,000 TONS OF ORGANIC WASTE EMITS THE SAME AMOUNT OF CO2-E AS 6,639 CARS ON THE ROAD IN A YEAR

Avoidable food wastes

7 Million tons

1.2M	0.8M EXPIRED	0.47M	0.46M	0.36M	0.3M	0.28
Cooked and served but not eaten	Expired food	Bad appearance	Mouldy	Cooked but not served	Perceived as inedible	Tastes or smells bad
3630M	2200M	990M	9900M	880M	990M	924M

514 Million dollars

174.75 Billion dollars

- Production, $2.2B — 1%
- Household, $120B — 69%
- Food service, $24.45B — 14%
- Wholesale and retail, $12.2B — 7%
- Processing, $15.9B — 9%

Sector wise cost associated with food waste

Historical

| 1970 | 2010 | 2050 | 2100 |

Increased conservation efforts + more sustainable production + more sustainable consumption

Increased conservation efforts

Business as usual

Homogeneous diets

Simplified landscapes

Hierarchy for food surplus and waste (Teigiserova et al., 2020)

From Farm to Fork
The European Green Deal

Most preferable

Feedstock examples		Treatment examples
All edible food	**Prevention**	Prevention and minimization at the source
Canned food, restaurants leftovers, misshaped FFV	**Reuse - H**	Redistribution to humans
Inedible parts of food, food after expiration date, defected food	**Reuse - A**	Animal feed
Food that lost its nutritional value, inedible such as peels, processing waste	**Material Recycling**	Material recovery e.g. keeping the value bound to the material (sauce, chips, acids, bioplastics...)
Rotten food, inedible such as cooking oil, dead animals, mixed household waste	**Nutrient Recovery**	Degradation of material value: anaerobic digestion, compost, land application
Rotten food, inedible such as cooking oil, dead animals, mixed household waste	**Energy Recovery**	Degradation of material value: biofuel production (ex. transesterification), incineration with energy recovery
Avoid if possible	**Disposal**	Landfill, incineration without energy recovery

Surplus food

Food waste

Feedstock examples

Treatment examples

Least preferable

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Prevention → NPO org

Reuse-Human → NPO org

Reuse-Animals → NPO org

Material Recovery → NPO org

Nutrient Recovery → NPO org

Energy Recovery

Consumption of Other Consumers' Plate Leftovers

Safety Needs

Health Risk

Physical Proximity

Relational Proximity

Physical Appearance

Source of Contamination

Natural Contamination

Leftover Appearance

Deliberate Contamination

Perceived Psychological Ownership

Disgust

Perceived Health Risk

bins

Home Biogas

Sorted Food waste

Mixed Food waste

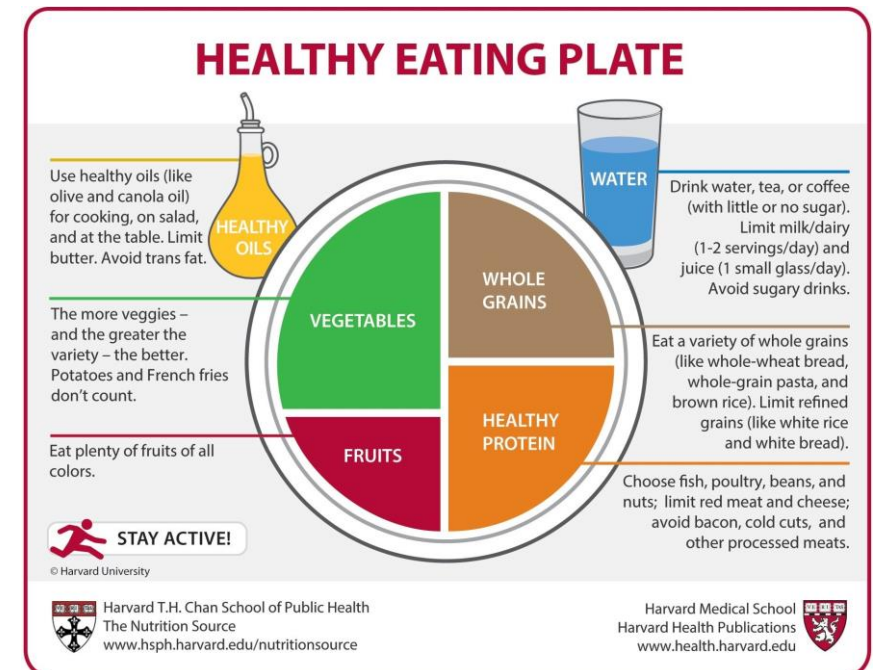| Nr.	Food group	Distribution period
1	Tea, coffee, cocoa	Up to two months
2	Cereals, legumes and their processing products (semolina, groats, flakes, semolina, etc.)	Up to two months
3	Pasta	Up to two months
4	Flour, flour mixtures	Up to two months
5	Starch	Up to two sronths
6	Honey, honey products	Up to two months
7	Canned vegeTables, fruits, berries, herbs, jams, jams, syrups	Up to two months
8	Sauces, ketchup, mustard, horseradish	Up to two months
9	Refined vegeTable oil	Up to two months
10	Unrefined vegeTable oil	Up to one month
11	Soft drinks, juices, nectars, water	Up to two months
12	Marshmallows	Up to two weeks
13	Sugar confectionery (caramels, lollipops, etc.)	Up to two suonths
14	Cookies, chips, salty snacks	Up to two months
15	Breakfast cereal, mussels	Up to two mronths
16	Dried fruits and vegeTables, spices	Up to two months
17	Sterilized fish products, animal products and mixed canned goods	Up to two months
18	Frozen plant-based products (berries, vegeTables, etc.)	Up to two months
19	Dry soups, jellies, potato porridge, etc. etc.	Up to two months
20	Cereal galettes, biscuits, dried apricots, etc. etc.	Up to two months
21	Bread	Two days
22	Pretzels, pretzels, cupcakes	Two days
23	Frozen dough, bread, muffins, pizzas	Up to two months
24	Candies, fruit-berry products	Up to two months
25	Salt, sugar, vinegar	Up to two months
26	Unroasted nuts and seeds and their products	Up to two months
27	Bread and muffins, packaged in a protective atmosphere	Up to two weeks
28	Beverages of herbal origin not mentioned in point 11 of this Annex	Up to two months
29	Plant-based desserts, soy products, tofu, sauces, soy sausages, wheat nuggets, pasties, etc. etc.	Up to two months
30	Ice cream	Up to two months

Key Aspects of Sustainable Food:

Environmental Impact:Sustainable food production minimizes the negative impact on the environment by reducing greenhouse gas emissions, conserving water, protecting biodiversity, and promoting soil health. Practices such as organic farming, agroecology, and regenerative agriculture are examples of environmentally sustainable methods that reduce chemical inputs, promote crop diversity, and enhance ecosystem resilience

Economic Viability: Sustainable food systems support local economies by providing fair wages and good working conditions for farmers, producers, and workers throughout the food supply chain. Economic sustainability also involves supporting small-scale and family-run farms, which are vital for maintaining rural livelihoods and promoting food security

Social Equity :A sustainable food system ensures that all people have access to affordable, nutritious food, regardless of their socioeconomic status. This includes addressing issues of food insecurity and promoting food sovereignty, which empowers communities to control their own food production and distribution

Health and Nutrition: Sustainable foods are often nutrient-dense, minimally processed, and free from harmful additives. They promote health by providing essential vitamins, minerals, and other nutrients while reducing the risk of diet-related diseases such as obesity, diabetes, and cardiovascular disease.

Ethical Considerations: Ethical concerns in sustainable food production include the humane treatment of animals, fair labor practices, and the ethical sourcing of ingredients. Sustainable food systems prioritize animal welfare and ensure that laborers are treated with dignity and respect, receiving fair compensation for their work

HEALTHY EATING PLATE

Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.

WATER
Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.

Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).

Eat plenty of fruits of all colors.

VEGETABLES

WHOLE GRAINS

FRUITS

HEALTHY PROTEIN

Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.

STAY ACTIVE!

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The Nutrition Source
www.hsph.harvard.edu/nutritionsource

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Intersection of Neurobiology and Eating Behavior

❑ Neurobiological Mechanisms: Various brain regions, including the hypothalamus, brainstem, and reward-related areas like the nucleus accumbens, play critical roles in hunger, satiety, and food reward processing.

❑ Influence of Hormones: Hormones such as leptin, ghrelin, and insulin significantly influence these brain regions, modulating feelings of hunger and fullness. For example, leptin decreases appetite by signaling satiety, while ghrelin increases hunger
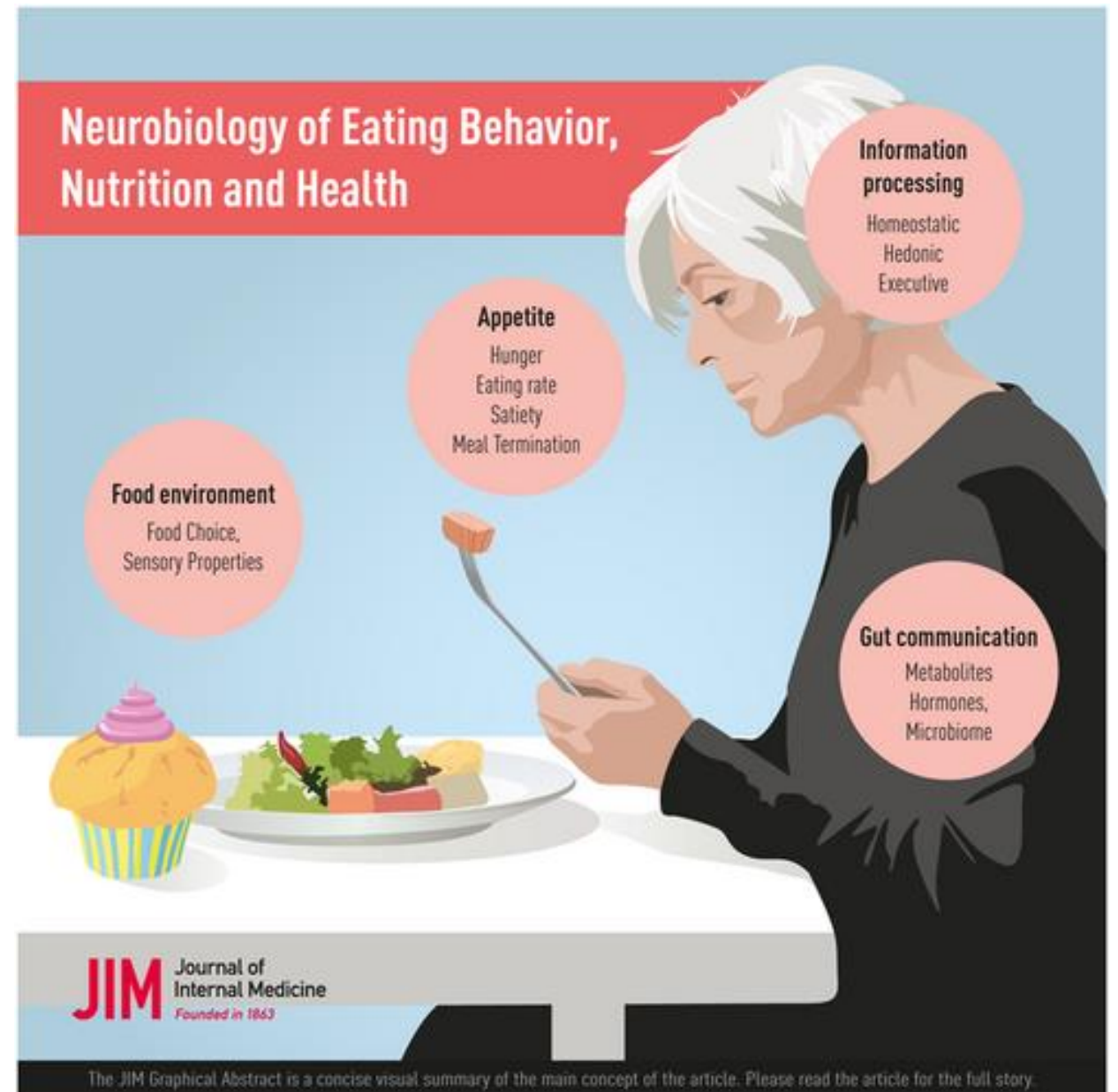
# Impact of Nutrition on Brain Function and Health

Diet and Mental Health:

•Processed Foods and Mental Health:

- Diets high in refined sugars and processed foods are linked to higher rates of depression and anxiety.
- These foods contribute to inflammation and disrupt neurotransmitter function.

•Whole Foods and Mental Health:

- Diets rich in fruits, vegetables, whole grains, and lean proteins are associated with better mental health outcomes.
- These diets provide essential nutrients that support brain function and reduce inflammation.
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Individual's Biology

Environmental Cues

Feedback

Eating Behavior
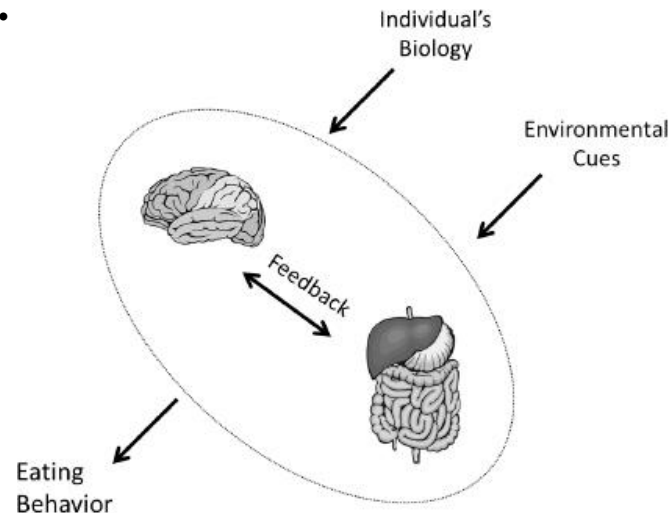
Nutritional Influences on Neurobiology:

•Omega-3 Fatty Acids:

- Essential for maintaining the structural integrity of neuronal membranes.
- Support synaptic plasticity, which is crucial for learning and memory.
- Found in fatty fish (salmon, mackerel), walnuts, flaxseeds, and chia seeds.

•Vitamins and Minerals:

- **B Vitamins (B6, B12, Folate):**
  - Vital for cognitive function, nerve signaling, and energy metabolism.
  - Deficiencies can lead to cognitive decline and mood disorders.
- **Iron:**
  - Important for oxygen transport in the brain, impacting cognitive performance.
  - Found in red meat, beans, spinach, and fortified cereals.
- **Magnesium:**
  - Supports neurotransmitter function and has a calming effect on the brain.
  - Found in leafy greens, nuts, seeds, and whole grains.

•Antioxidants:

- Protect the brain from oxidative stress and inflammation.
- Foods rich in antioxidants include berries, dark chocolate, and green tea.

Personalized Nutrition and Future Directions

Precision Nutrition Approaches:

•**Genetic, Metabolic, and Behavioral Profiles:**

- Personalized nutrition tailors dietary recommendations based on an individual's genetic makeup, metabolic status, and behavioral habits.

- Example: Individuals with certain genetic predispositions may benefit from specific dietary interventions to manage conditions like obesity, heart disease, or diabetes.

•**Microbiome Influence:**

- The gut microbiome plays a critical role in determining an individual's response to different foods.

- Personalized nutrition can include microbiome assessments to optimize diet for improved gut health and overall well-being.
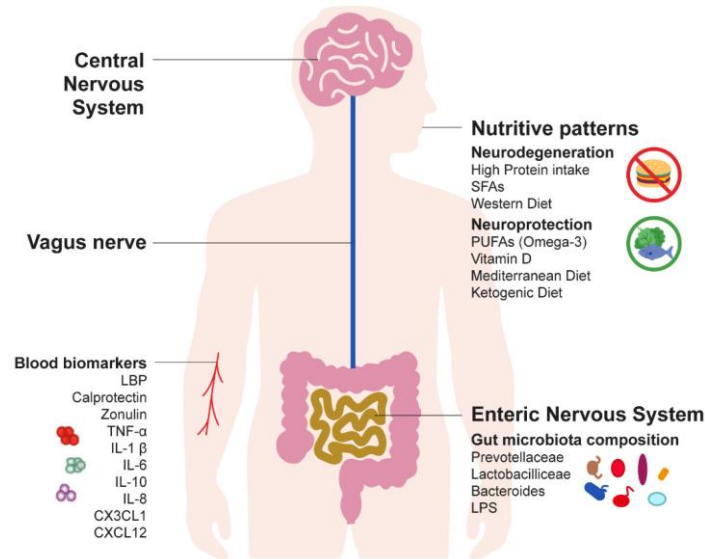
Behavioral and Pharmacological Interventions:

•**Behavioral Interventions:**

- Cognitive-behavioral therapy (CBT) is effective in treating eating disorders by addressing the cognitive distortions and behaviors that sustain these conditions.

- Mindful eating practices help individuals develop a healthier relationship with food, focusing on hunger and satiety cues rather than emotional triggers.

•**Pharmacological Treatments:**

- Emerging drugs target specific neural pathways involved in appetite regulation and reward processing, offering new treatments for obesity and eating disorders.

- These pharmacological interventions are often most effective when combined with behavioral therapies.

Role of Technology:

Digital Health Tools:

- Mobile apps and wearable devices can track dietary intake, physical activity, and even emotional states, providing real-time feedback and support for healthy eating behaviors.

AI-driven Personalized Diets:

- Artificial intelligence can analyze large datasets to provide personalized dietary recommendations that optimize health outcomes based on individual needs.

Central Nervous System

Vagus nerve

Nutritive patterns
Neurodegeneration
High Protein intake
SFAs
Western Diet
Neuroprotection
PUFAs (Omega-3)
Vitamin D
Mediterranean Diet
Ketogenic Diet

Blood biomarkers
LBP
Calprotectin
Zonulin
TNF-α
IL-1 β
IL-6
IL-10
IL-8
CX3CL1
CXCL12

Enteric Nervous System
Gut microbiota composition
Prevotellaceae
Lactobacilliceae
Bacteroides
LPS

That is all for today!