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ULTRAPROCESSED FOODS: DANGER OF MOLECULAR FRAGMENTATION

INTRODUCTION

Fast growing obesity in the population of our country raises a question: WHY? Especially when compared to the other countries of the world. In our first podcast, we discussed "ULTRAPROCESSED FOODS – SOFT ADDICTION".

Now we move to the next podcast, ULTRAPROCESSED FOODS – MOLECULAR FRAGMENTATION." In this podcast we will suggest that molecular fragmentation that occurs during food's ultra-fine processing may be a direct threat to your health with multiple negative health consequences. By that are related to biology, and potential consequences of

In short, molecular fragmentation of grown produce and meats may pulverize them to the particulates of sub-micrometer size that are comparable to the nucleus of organic cells.

HYPOTHESIS

Our main hypothesis is that on the way to the sub-micrometer size, a certain number of organic cells, intact prior to processing and harmless to humans when consumed, are destroyed completely and numerous fragments of cells nuclei are created. Since the process of fragmentation is random, a large variety of fragments of different sizes and molecular composition join the mix: some harmless, and some not.

Obviously, this hypothesis is a subject to research, and until we have scientifically substantiated evidence that the fraction of harmful molecular fragments is negligible low, the ultra-processed foods must be consumed and treated with caution.

This is the second of our two podcasts related to ultra-processed foods.

INFORMATION

Here's some relevant information from food processing procedures with focus on biology:

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1. Shredding in Food Processing

In the production of many ultra-processed foods, actual produce, meats, and other ingredients are often shredded, ground, or pulverized into very small particulates, sometimes resembling powders or pastes. This process serves multiple purposes:

- **Consistency and Uniformity**: Breaking down ingredients ensures a consistent texture and facilitates reshaping into uniform products (e.g., nuggets, patties, or extruded snacks).

- **Enhanced Processing**: Smaller particles mix better with additives, fillers, and binders.
- **Increased Shelf Life**: Finer particles can be dehydrated or preserved more efficiently.
- **Customization**: Allows manufacturers to manipulate textures, shapes, and consistencies that are appealing to consumers.

For example:

- In processed meats like hot dogs or nuggets, muscle tissue is often broken down into a paste or emulsion.
- In plant-based products, vegetables can be powdered or liquefied before being reconstituted into forms like chips or extruded snacks.

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2. Smallest Size of Particulates After Shredding

The size of particulates after shredding depends on the processing method:

- **Mechanical Shredding**: Typically results in particle sizes ranging from **0.1 mm to several millimeters**, depending on the intended texture.
- **Advanced Milling (e.g., Powdering)**: Industrial grinders or pulverizers can reduce particles to sizes of **10–100 microns** (micrometers), resembling fine powders.

In products like plant-based meat substitutes or powdered food additives, particles may be further reduced to **sub-micron sizes** for better binding and consistency.

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3. Average Size of Biological Cells

The size of biological cells varies significantly depending on the type of organism and tissue:

(a) Grown Produce (Plant Cells):

- Plant cells are typically **10–100 microns** in diameter.
- Cell walls, made of cellulose, are quite robust and contribute to the structure and texture of fresh produce.
- When shredded or processed, plant cells are often broken down completely, releasing their contents and leaving only cellulose or fibrous remnants.

(b) Meats (Animal Cells):

- Animal cells, such as muscle cells (myocytes), are generally **10–100 microns** in diameter, but their length can be much longer (up to several millimeters for muscle fibers).
- Processing meat, such as grinding or emulsifying, usually destroys the cellular structure, reducing it to smaller fragments.

Comparison of Particulate Sizes in Processed Foods:

Material	Typical Particulate Size After Processing	Cell Size (Before Processing)
Plant-Based Ingredients	10–100 microns (fine powder)	10–100 microns (plant cells)
Meat (Animal-Based)	50–500 microns (paste/emulsion)	10–100 microns (muscle cells)

Implications:

1. **Structural Alteration**: Processing significantly alters the natural structure of food, breaking down cells into sub-cellular fragments or molecular components.
2. **Loss of Integrity**: This makes food easier to reshape but also often reduces its nutritional integrity (e.g., fiber or natural protein matrices).
3. **Digestibility and Bioavailability**: Ultra-fine processing can increase digestibility but may also lead to rapid absorption of sugars or fats, contributing to metabolic issues.

This level of processing highlights how manufacturers can reshape raw ingredients into completely new forms while simultaneously obscuring their origins and reducing their natural qualities.

SIZES

Nucleus Sizes in Plant Cells (Grown Produce)

- Plant cells generally have larger nuclei than animal cells due to their larger cell sizes and genome complexity.
- **Typical size of a plant cell nucleus**:
  - **Diameter**: ~**5–20 micrometers (µm)**
    - This varies significantly based on species and cell type. For example:
      - **Leaf cells**: Larger nuclei, up to **15–20 µm**.
      - **Root cells**: Smaller nuclei, ~**5–10 µm**.
  - Example species:
    - **Wheat**: Nucleus diameter ~8–15 µm.
    - **Tomato**: Nucleus diameter ~5–10 µm.

Nucleus Sizes in Animal Cells (Meats: Beef and Poultry)

- Animal cell nuclei are smaller and more consistent in size compared to plant cells.
- **Typical size of an animal cell nucleus**:
  - **Diameter**: ~**5–10 micrometers (µm)**
    - **Beef (cow muscle cells)**: ~5–7 µm.
    - **Poultry (chicken muscle cells)**: ~5–8 µm.

Factors Affecting Nucleus Size

1. **Genome Size**:
   - Larger genomes (more DNA) generally require larger nuclei to house the genetic material.
   - Plants often have larger genomes than animals, contributing to their larger nuclei.
2. **Cell Type**:
   - **Muscle Cells**: In animals, muscle cells (myocytes) have smaller, tightly packed nuclei compared to other cell types.
   - **Photosynthetic Cells**: In plants, cells in leaves and stems often have larger nuclei due to their active metabolic roles.
3. **Polyploidy**:
   - Some plant cells are polyploid, meaning they have multiple copies of the genome, leading to larger nuclei.
   - Certain animal cells (e.g., liver cells) may also exhibit polyploidy, resulting in larger nuclei.

Summary Table of Nucleus Sizes

Organism	Tissue/Cell Type	Nucleus Diameter (µm)
Wheat (Plant)	Leaf Cells	8–15 µm
Tomato (Plant)	Root Cells	5–10 µm
Beef (Animal)	Muscle Cells (Myocytes)	5–7 µm
Chicken (Animal)	Muscle Cells (Myocytes)	5–8 µm

Key Takeaways

- **Plant nuclei are larger** on average than animal nuclei due to larger genome sizes and more diverse cell functions.
- Animal nuclei in meat tissues (muscles) tend to be relatively small and uniform in size, reflecting the structural and metabolic demands of those tissues.