Society for Nutrition Education and Behavior, 2019 Annual Conference, July 27-30, 2019, Orlando, FL
George M. Briggs Science Symposium: Diet Quality Assessment using Food Processing as a Criterion: Current Status and Future Research Directions

Why food processing matters to understand diet and health in the 21st century

(with an emphasis on epidemiological evidence)

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Why food processing matters to understand diet and health in the 21st century

- Diet and health: a complex relationship
- The role of food processing on this relationship
- **Evidence on the impact of ultra-processed foods on diet quality and health**
- Policy implications

Narrow and broad views of health

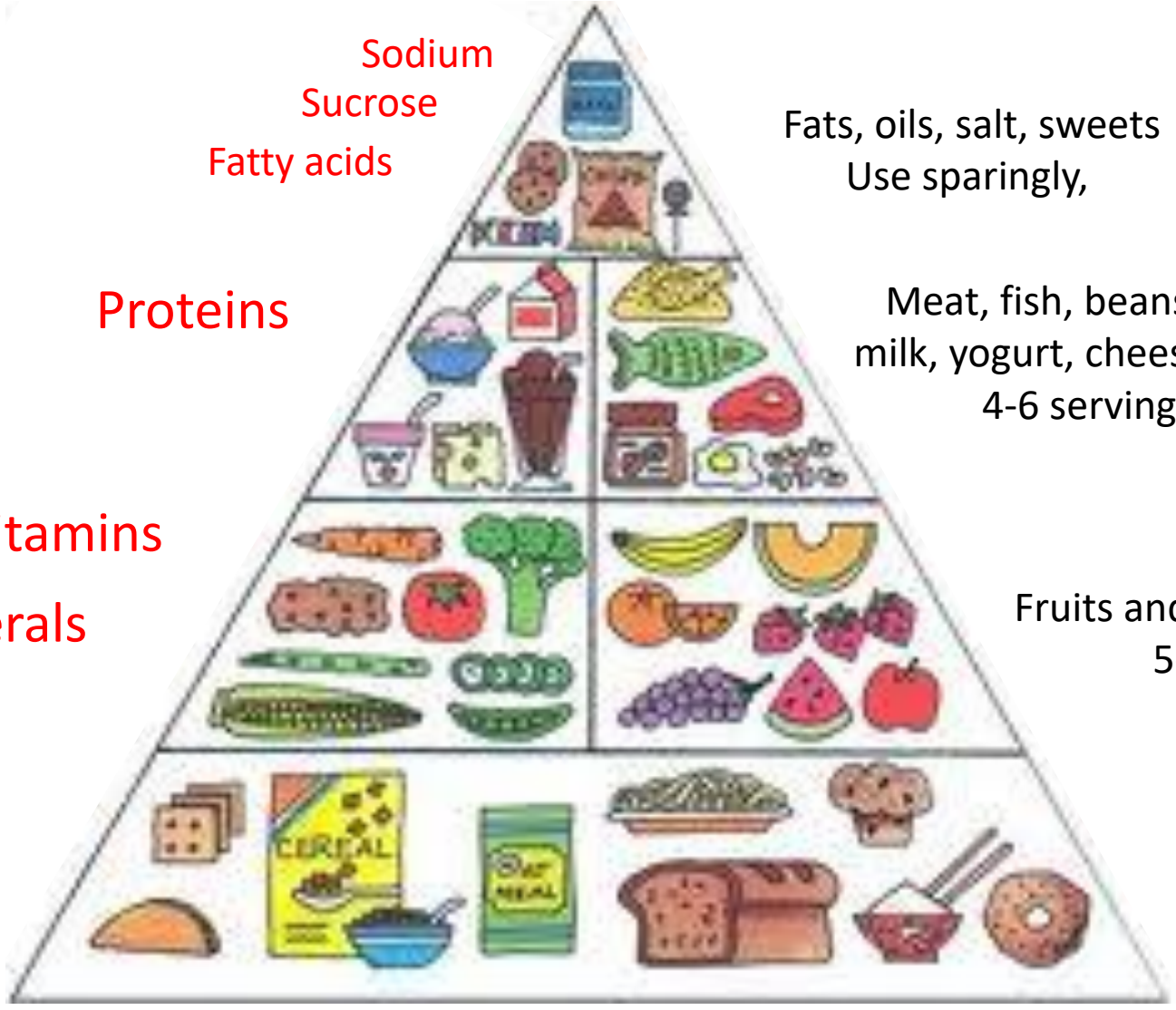
Health as the mere absence of disease

vs.

*Health as a state of complete physical, mental and social well-being**

*Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19 June - 22 July 1946

There is also a narrow view on diet …



Sodium
Sucrose
Fatty acids

Fats, oils, salt, sweets
Use sparingly,

Proteins

Meat, fish, beans, eggs
milk, yogurt, cheese group
4-6 servings

Vitamins

Minerals

Fruits and vegetables group
5-9 servings

Carbohydrates

Cereal group
6-11 servings

For 'nutritionism', Soylent would be an option for 'healthy diets'

252g HIDRATOS DE CARBONO

114g PROTEÍNA

70g ÁCIDOS GRASOS

2.5g OMEGA 3 ÁCIDOS GRASO

27g FIBRA

3500mg POTASIO

1050mg SODIO

1000mg CALCIO

700mg FÓSFORO

400mg MAGNESIO

1375mg VITAMINA BP

90mg VITAMINA C

16mg VITAMINA B3

15mg VITAMINA E

11mg ZINC

21.5mg HIERRO

5mg VITAMINA B5

2.3mg MANGANESO

HOW**SOYLENT**WORKS

Soylent vs. Food

Based on a 30-year-old man,
6 feet, 165 pounds, physically active
30 to 60 minutes a day

SOYLENT

1 powdered pouch =
2,000 calories (2 scoops)
1/4 pouch
(500 calories) = 1 meal

What's in it?

Brown rice, oat flour, isomaltulose, potato starch, rice starch, cellulose, sucralose, high oleic sunflower oil, soy lecithin, flaxseed , safflower oil, algal oil, blend of vitamins and minerals

Carbohydrates
51 grams
(4 grams fiber,
11 grams sugar)

Fat
24 grams
(3 grams saturated fat)

Protein **21 grams**

Plus micronutrients like:
Potassium, Vitamin C, Copper, Sodium, Calcium

FOOD

Daily plan of 2,800 calories

Grains: 10 ounces
Bread, pasta, cereals

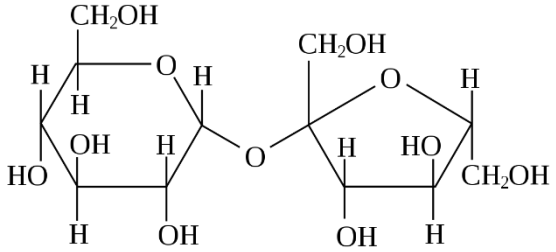
Vegetables: 3.5 cups
Dark leafy greens, beans, peas, lentils, potatoes, corn, taro, squash, carrots, peppers

Fruits: 2.5 cups
Apples, melons, berries, citrus and 100% fruit juice

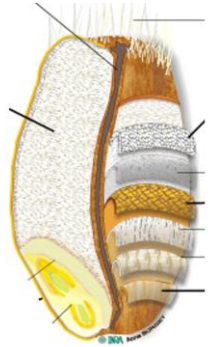
Dairy: 3 cups
Milk, cheese, ice cream, yogurt

Protein: 7 ounces
Meats, poultry, eggs, beans, fish, nuts

Four elements in diet influence health:



Nutrients



Foods
(more than nutrients!)

Meals
(more than foods!)

Eating modes
(when, where, how?)

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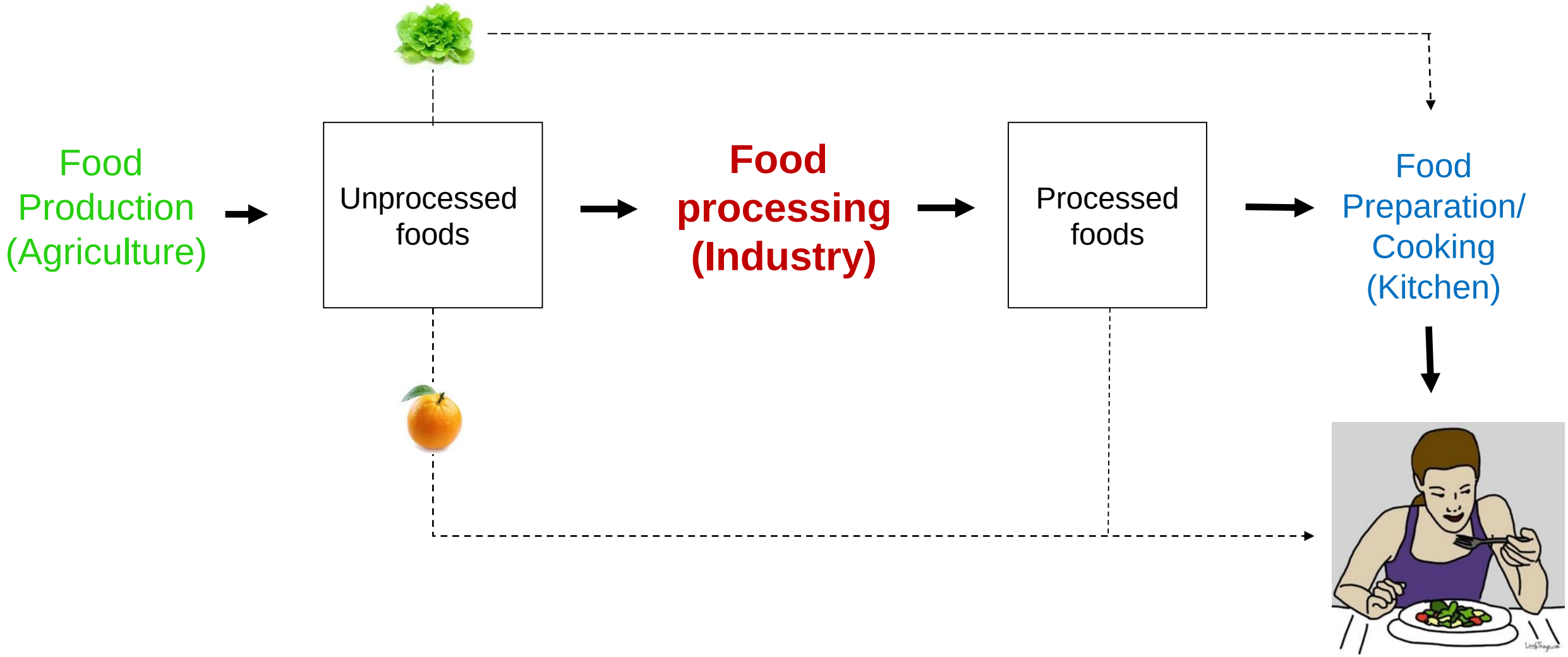
Food processing within the food system



What is the purpose of food processing?

Food processing to increase **food** duration, to make easier/more diverse **food** preparation, or to modify/enhance **food** sensorial properties

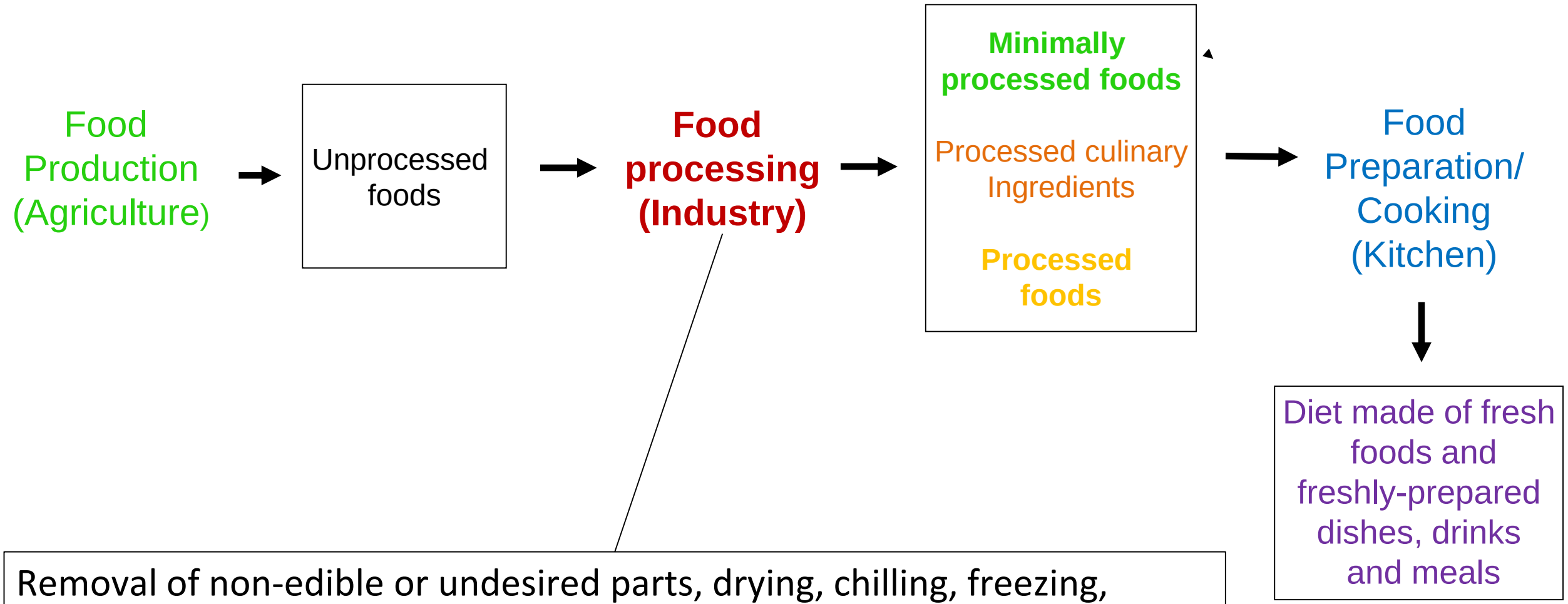
Food Production (Agriculture)

Unprocessed foods

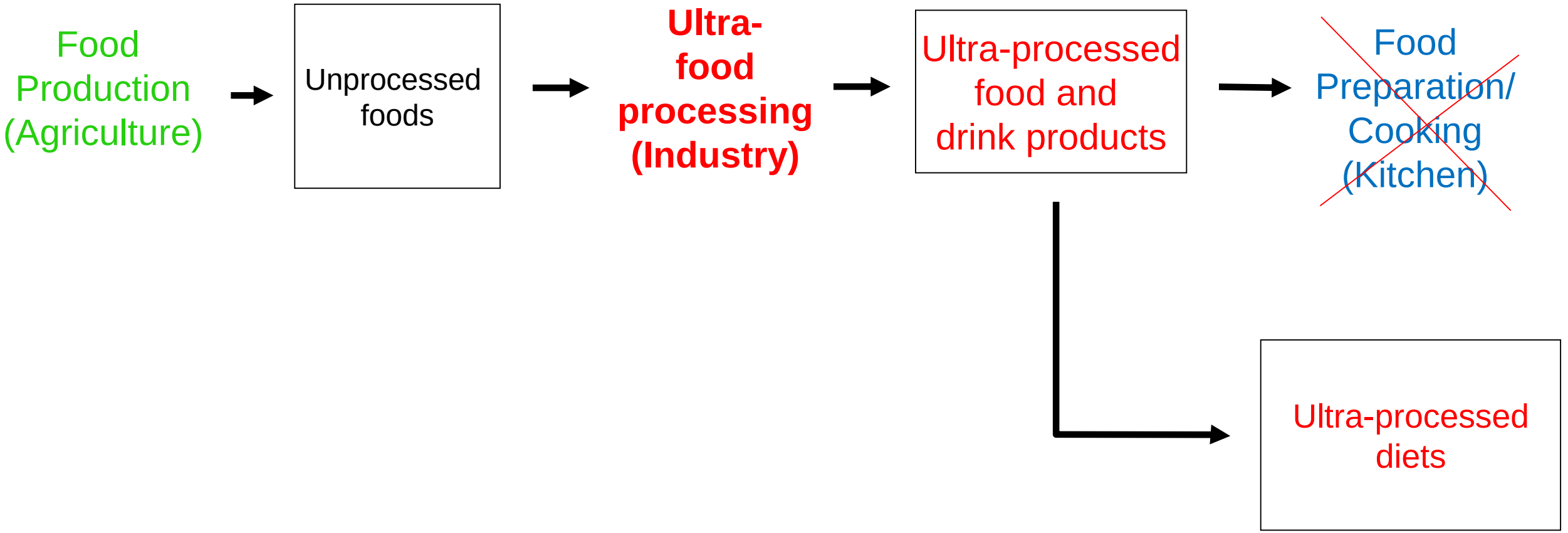
Food processing (Industry)

Food Preparation/ Cooking (Kitchen)

Processes used in the manufacture of NOVA groups 1 to 3



Food processing aiming convenient (ready-to-eat or heat, imperishable), low cost, and tasteful products liable to replace all other NOVA groups



Food processing aiming convenient (ready-to-eat or heat, imperishable), relatively cheap and tasteful products liable to replace all other NOVA groups

Food Production (Agriculture) → Unprocessed foods → **Ultra-food processing (Industry)** → Ultra-processed food and drink products → ~~Food Preparation/ Cooking (Kitchen)~~

Ultra-processed foods are manufactured and marketed to replace fresh foods and freshly prepared drinks, dishes and meals

What processes are involved with food ultra-processing?

Food Production (Agriculture) → Unprocessed foods → **Food ultra-processing (Industry)** → Ultra-processed foods → ~~Food Preparation/ Cooking (Kitchen)~~

Extraction of oils/fats/sugar/starches/protein contained in foods

↓

Chemical modifications of substances obtained from foods (hydrogenation …)

↓

Assembly of unmodified and modified food substances (extrusion, deep frying …)

↓

Use of cosmetic additives (flavours, colours, emulsifiers …)

↓

Sophisticated packaging often using synthetic materials.

Most basic ingredients of ultra-processed foods come from a few-high yield plant foods and intensive livestock farming

→ Unprocessed foods → **Food ultra-processing (Industry)** → Ultra-processed foods → ~~Food Preparation/ Cooking (Kitchen)~~

Extraction of **oils/sugar/starches/protein** contained in foods

↓

Chemical modifications of substances obtained from foods

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Assembly of unmodified and modified food substances

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Use of cosmetic additives (flavours, colours, emulsifiers …)

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NOVA group 4 favors unhealthy eating modes

Food Production (Agriculture) → Unprocessed foods → **Ultra-food processing (Industry)** → Ultra-processed food and drink products → ~~Food Preparation/ Cooking (Kitchen)~~

NOVA groups 1 to 3 favor healthy eating modes

Food Production (Agriculture)

Unprocessed foods

Food processing (Industry)

Food Preparation/ Cooking (Kitchen)

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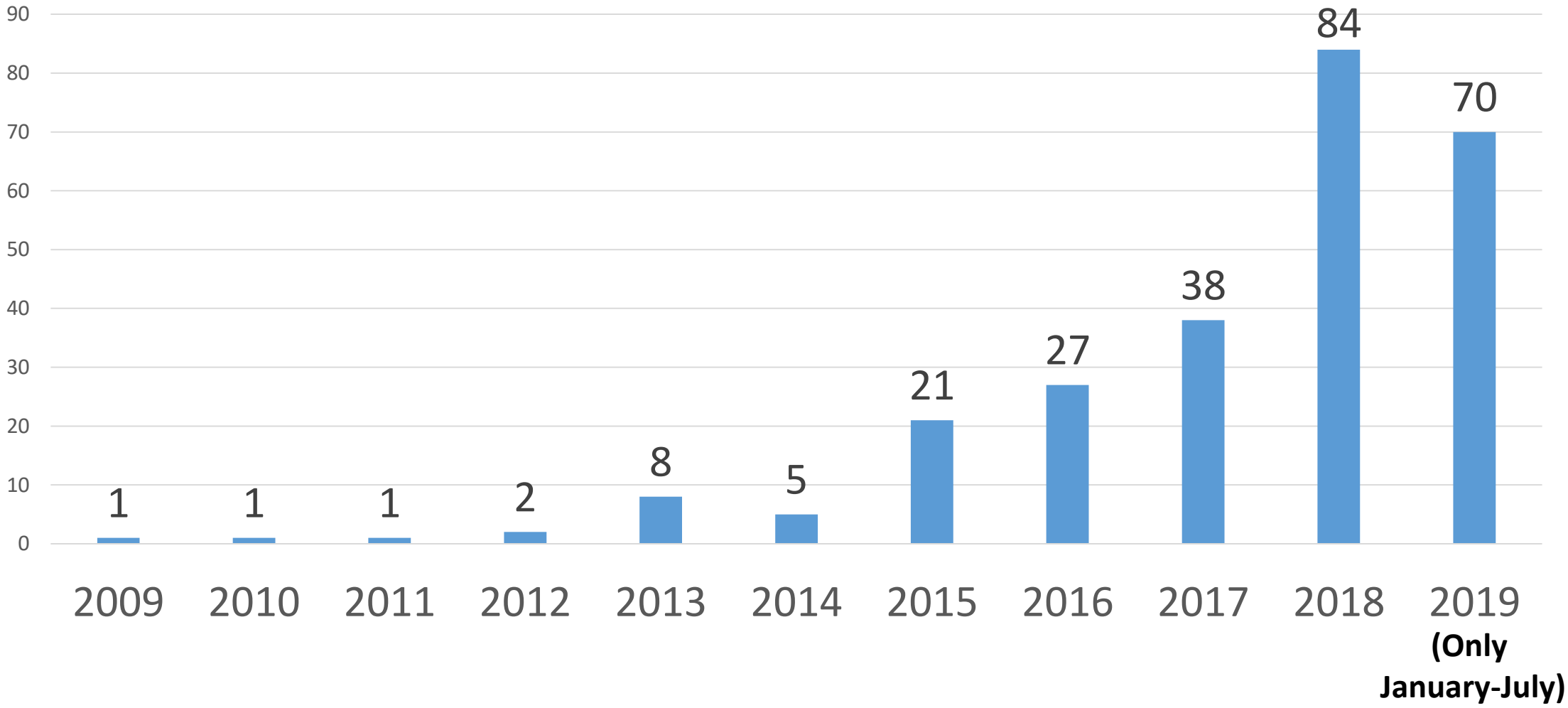
NOVA food groups	Examples
1) Unprocessed or minimally processed foods	   
2) Processed culinary ingredients	   
3) Processed foods	   
4) Ultra-processed foods Formulations resulting from a sequence of processes that include the fractioning of whole foods into substances, the modification and recombination of these substances, use of of cosmetic additives, and often sophisticated packaging, all aiming to obtain durable, ready-to-consume, hyper-palatable, and highly profitable products with potential to replace all other food groups	         

Source: Monteiro et al 2017, *Public Health Nutrition*

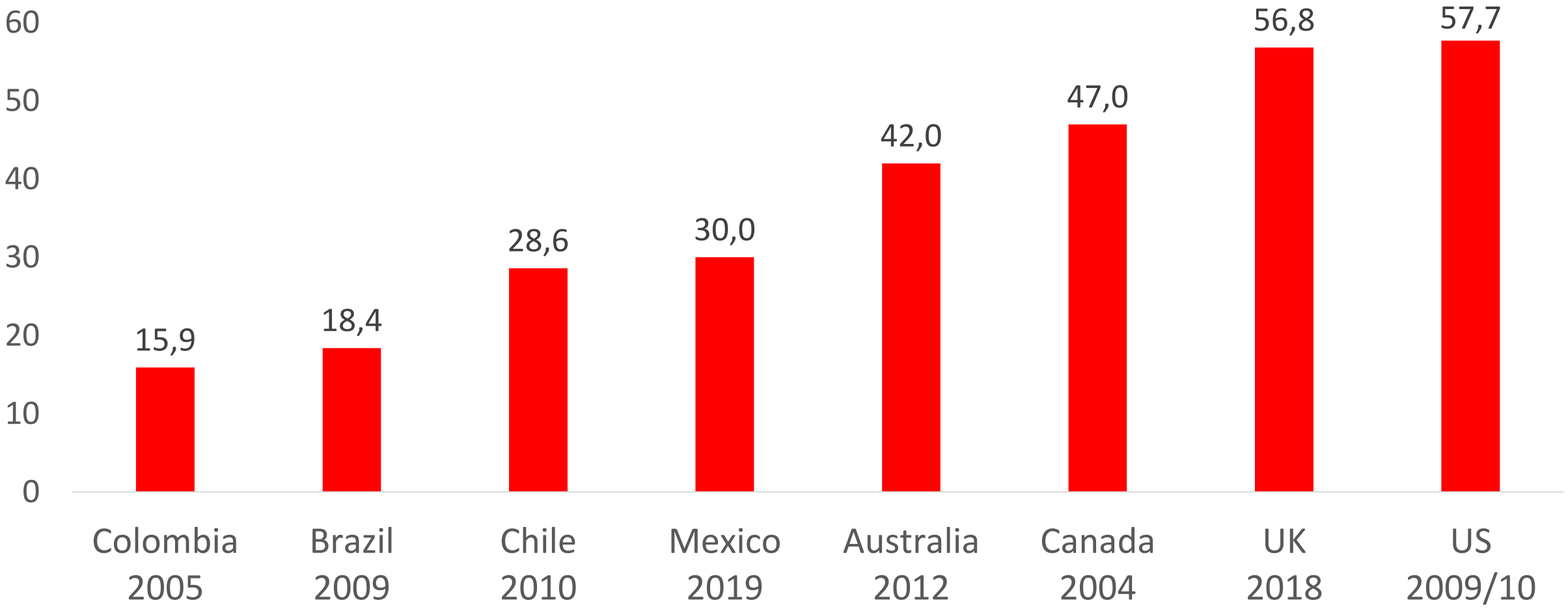
Articles in PubMed with the term ‘ultra-processed’



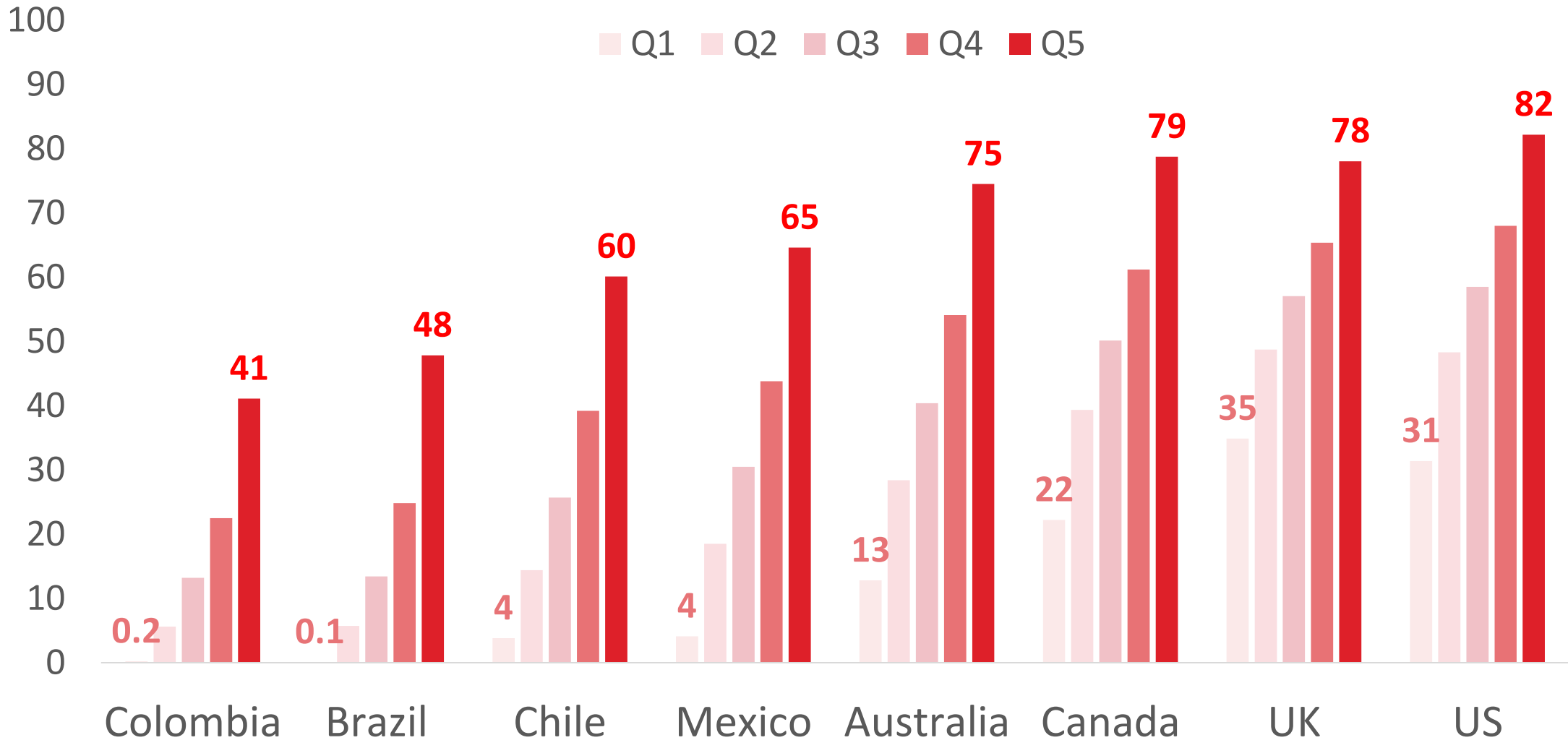
Why food processing matters to understand diet and health in the 21st century

- **The impact of ultra-processed foods on:**
  - **Diet quality**
  - **NCDs**

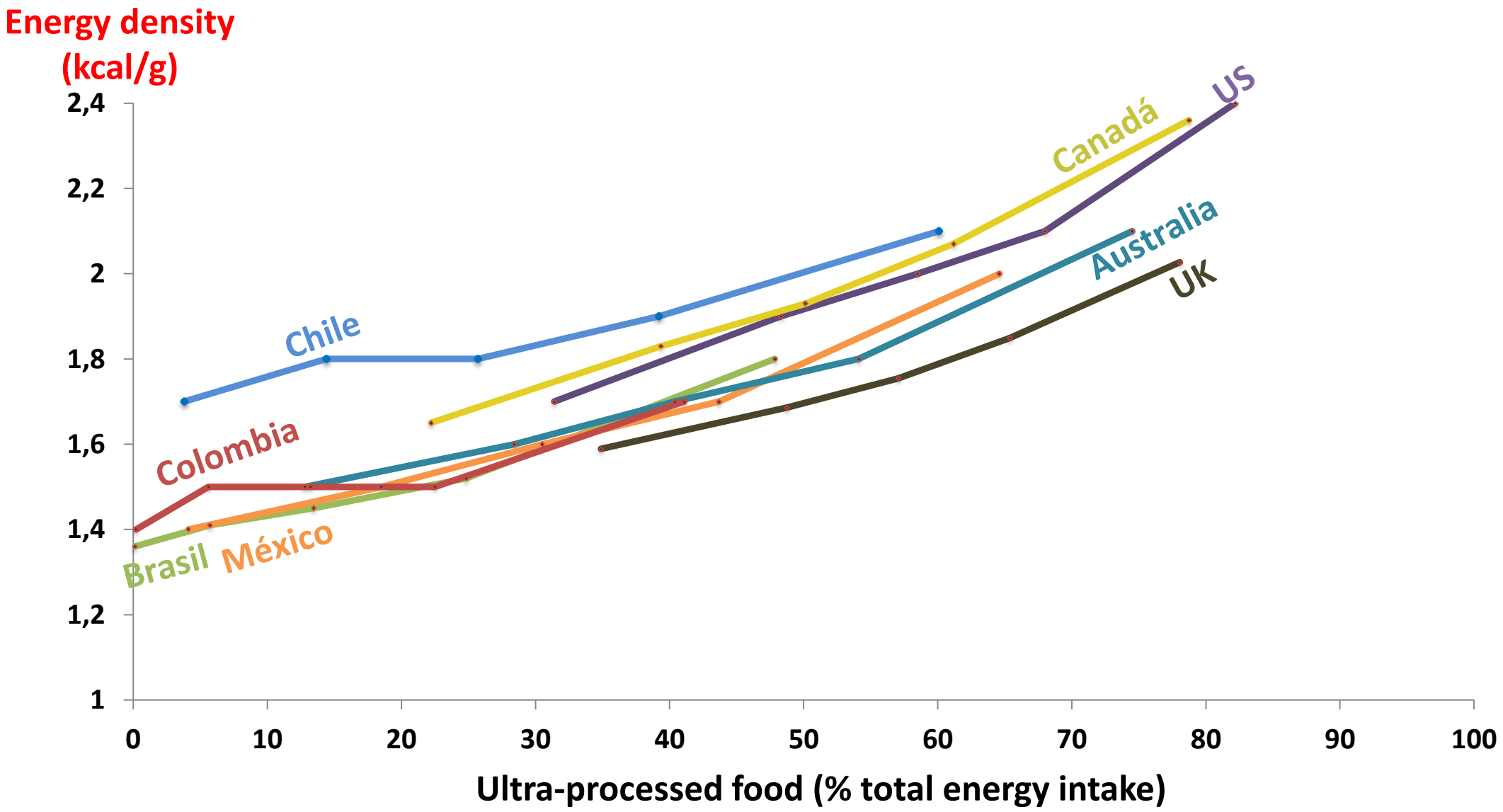
Dietary share of ultra-processed foods in 8 countries
(% of total energy intake)



Quintiles (Q) of the dietary share of ultra-processed foods (% of total energy intake)



Diet quality according to quintiles of ultra-processed food intake NOVA multi-country study, 2005-2014.



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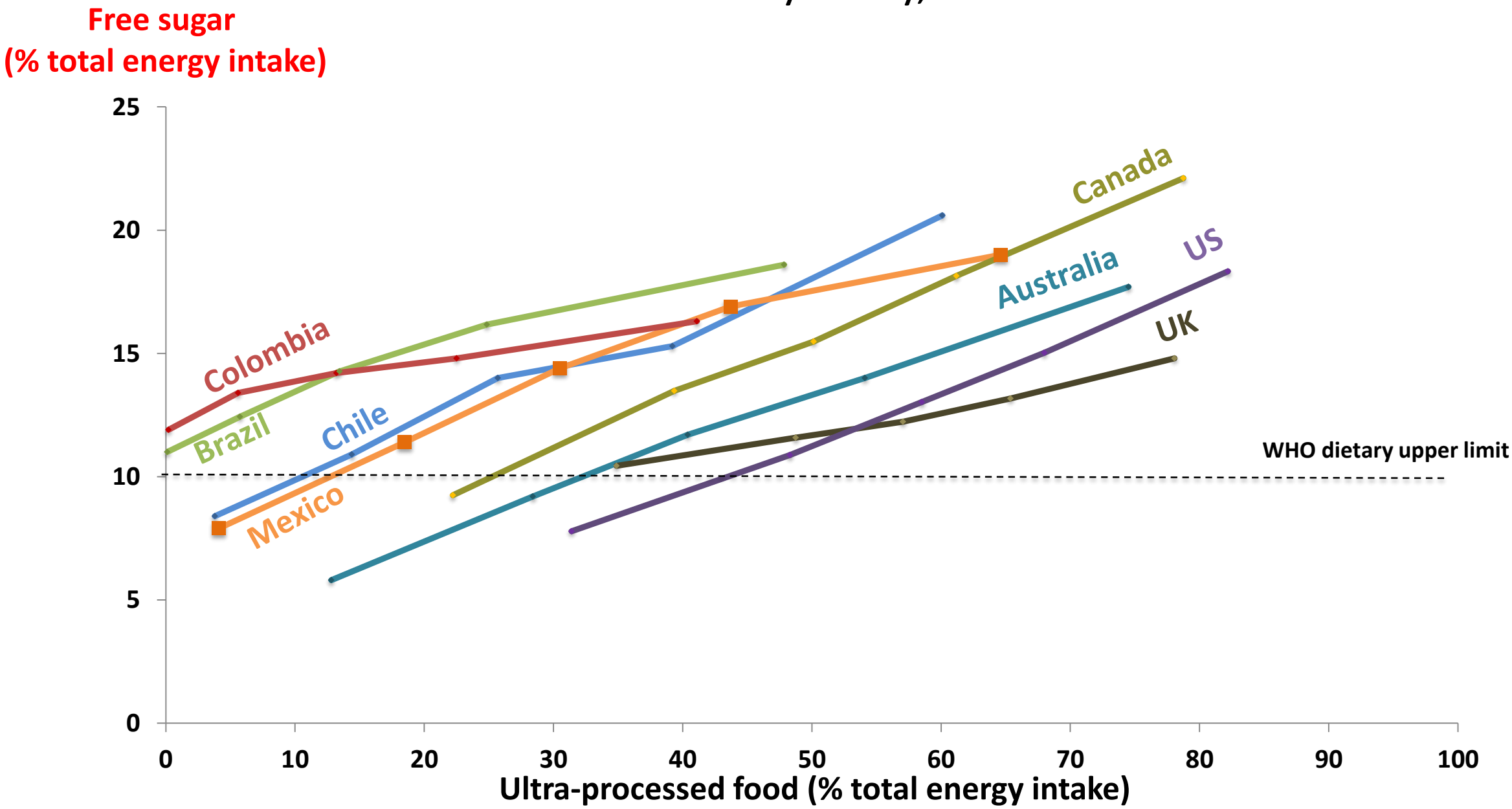

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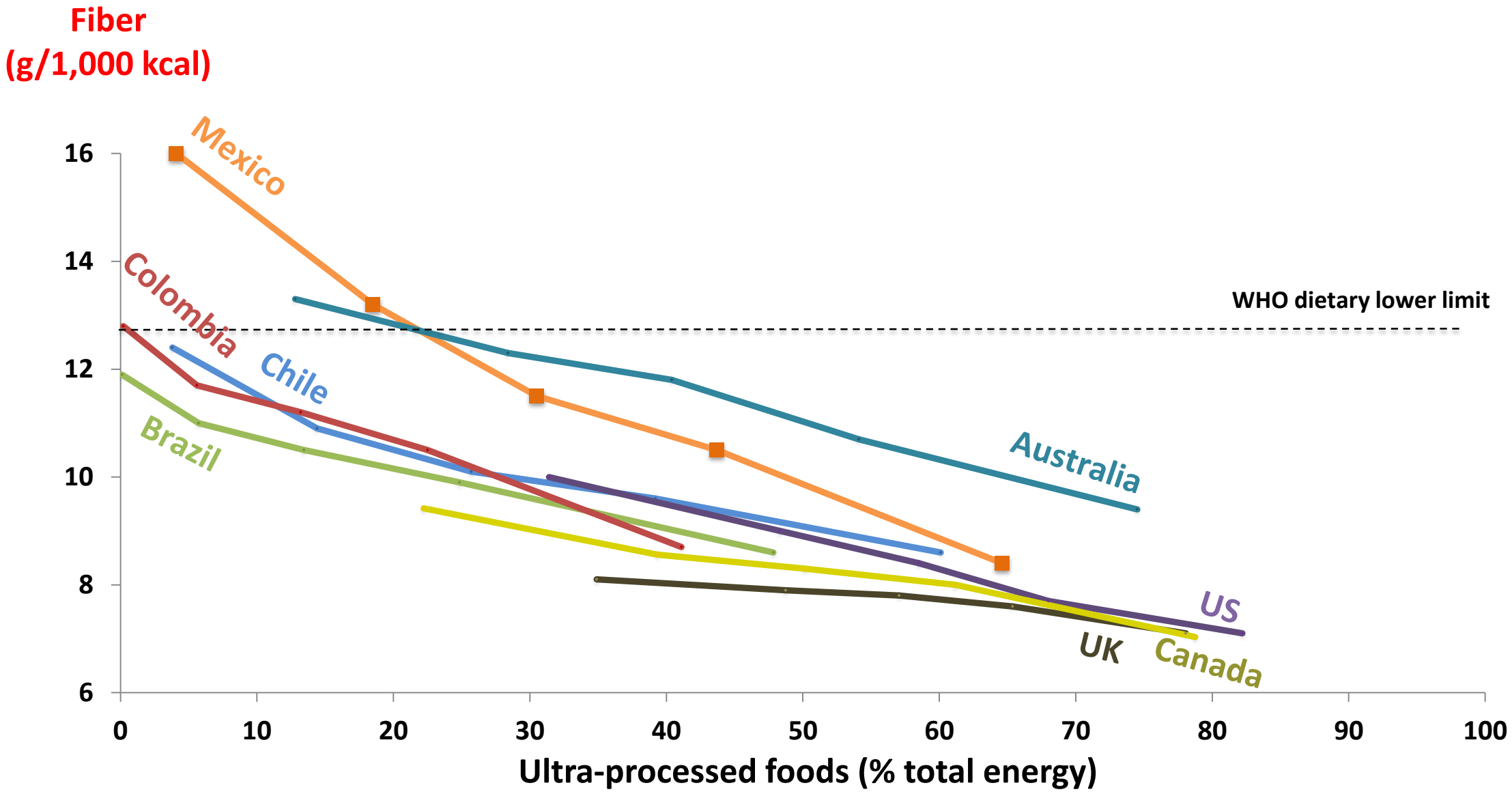


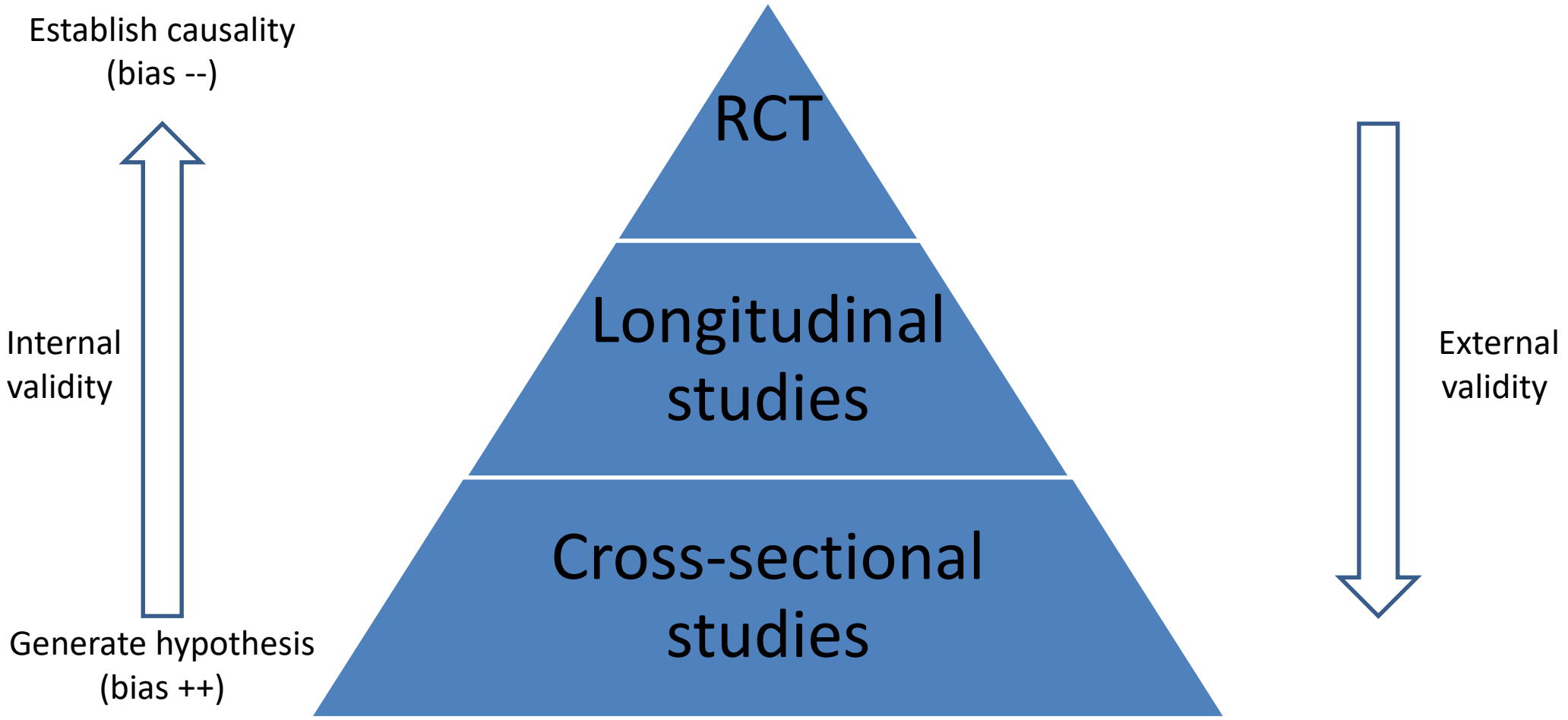
Potentially harmful UPF attributes other than their unbalanced nutrient profile

- **'Acellular' nutrients and additives and their effect on microbiome** (Zinocker & Lindseth 2018)
- **Absence or low concentration of bioactive compounds** (Martinez-Steele & Monteiro 2017)
- **High glycemic index and low satiety** (Fardet 2016)
- **Hyper-palatability** (Kessler 2009; Brownell 2012; Moss 2013; Ifland 2018)
- **Mindless eating** (Cohen & Farley 2008)
- **Aggressive and sophisticated marketing**

Why food processing matters to understand diet and health in the 21st century

- **The impact of ultra-processed foods on:**
  - Diet quality
  - **NCDs**

Hierarchy of designs for cause-probing research questions*



Adapted from www.cebma.org/faq/what-are-the-levels/of/evidence

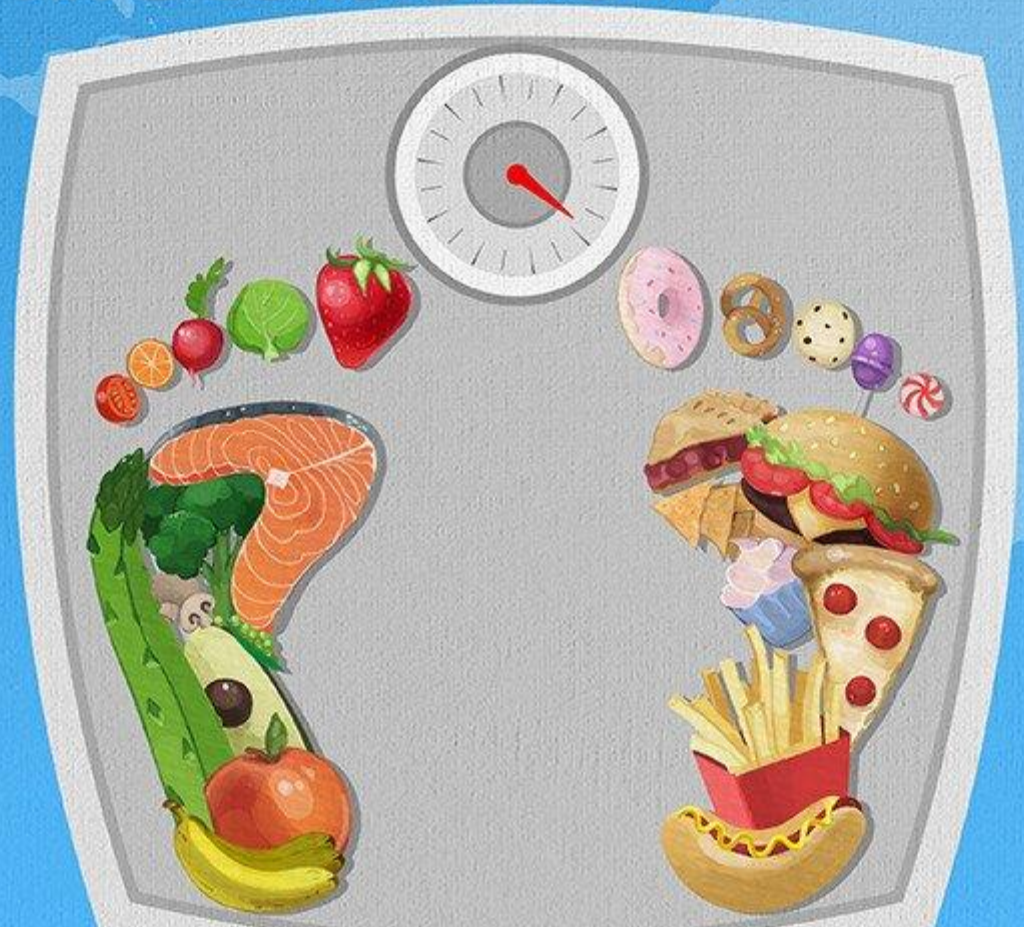
NUPENS
USP

Volume 30
Number 1

July 2, 2019

www.cell.com

Cell Metabolism



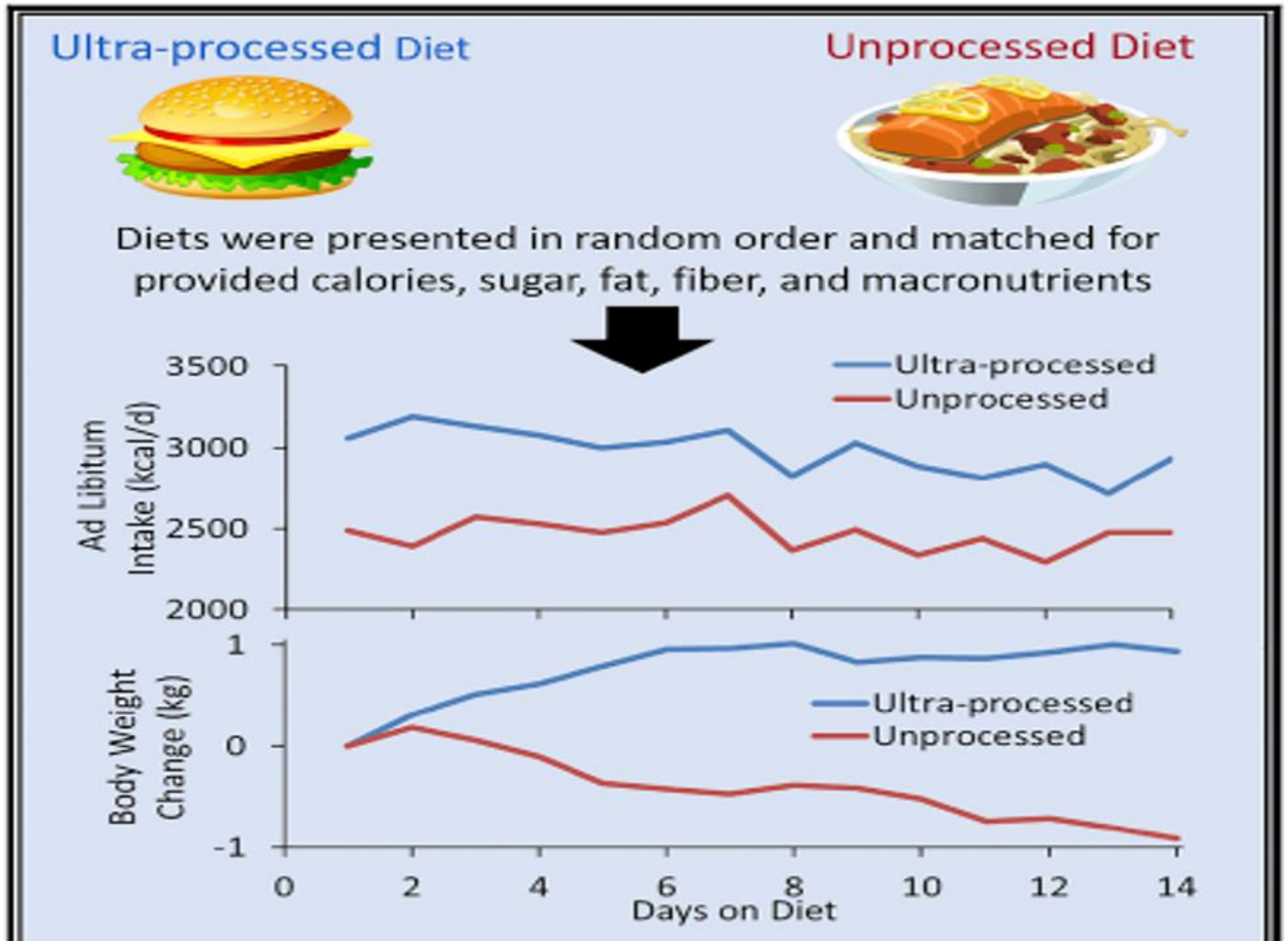
Ultra-Processed Foods and Obesity

Clinical and Translational Report

Cell Metabolism

Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of *Ad Libitum* Food Intake

Graphical Abstract



Authors

Kevin D. Hall, Alexis Ayuketah, Robert Brychta, ..., Peter J. Walter, Shanna Yang, Megan Zhou

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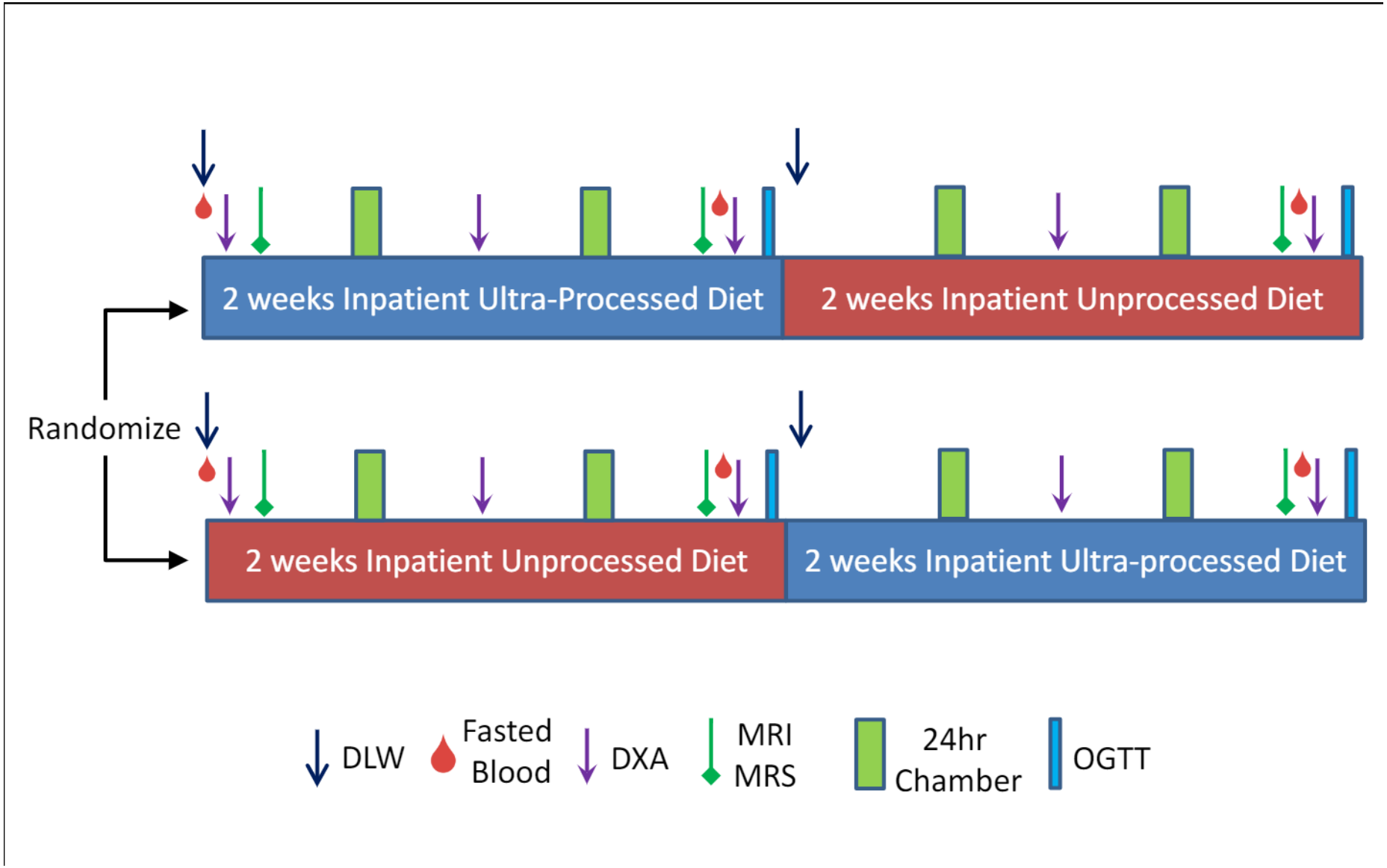
In Brief

Hall et al. investigated 20 inpatient adults who were exposed to ultra-processed versus unprocessed diets for 14 days each, in random order. The ultra-processed diet caused increased *ad libitum* energy intake and weight gain despite being matched to the unprocessed diet for presented calories, sugar, fat, sodium, fiber, and macronutrients.



Overview of the study design. Twenty adults were confined to metabolic wards where they were randomized to consume either an ultra-processed or unprocessed diet for 2 consecutive weeks followed immediately by the alternate diet.

Ultra-processed Menu
Day 2
Breakfast
Croissant (Chef Pierre)
Margarine (Glenview Farms)
Turkey sausage (Ember Farms)
Blueberry yogurt (Yoplait) with NutriSource fiber

Non ultra-processed Menu
Day 2
Breakfast
Scrambled egg (made from fresh eggs)
Hash brown potatoes (potato, garlic, paprika (Simply Organic), ground turmeric (McCormick), cream (Stoneyfield) and onions)
Salt and Pepper (Monarch)

Ultra-processed Menu
Day 4
Lunch
Hot dog (Patunxent Farms) on bun (Hilltop Hearth) with ketchup (Heinz) and yellow mustard (Monarch)
Baked potato chips (Lay's)
Cranberry juice (Sun Cup) with NutriSource fiber
Blueberry yogurt (Yoplait) with NutriSource fiber

Non ultra-processed Menu
Day 4
Lunch
Baked cod filet (Harbor Banks) with fresh squeezed lemon juice
Baked russet potato with olive oil
Steamed broccoli with olive oil and garlic
Side salad (green leaf lettuce, tomatoes, cucumber and carrots)
Vinaigrette (balsamic vinegar (Nature's Promise) and olive oil)
Salt and Pepper (Monarch)

Ultra-processed Menu
Day 7
Dinner
Peanut butter (Monarch) and jelly (Monarch) sandwich on white bread (Ottenberg)
2% milk (Cloverland) with NutriSource fiber
Baked Cheetos (Frito-Lay)
Graham crackers (Nabisco)
Chocolate pudding (Snack Pack) with NutriSource fiber

Non ultra-processed Menu
Day 7
Dinner
Penne pasta (Barilla) primavera (olive oil, garlic, pinto beans (cooked from dried), spinach, basil, tomatoes)
Side salad (green leaf lettuce, baby carrots, broccoli)
Vinaigrette (red wine vinegar (Giant) and olive oil)
Salt and Pepper (Monarch)
Grapes

Ultra-processed Menu

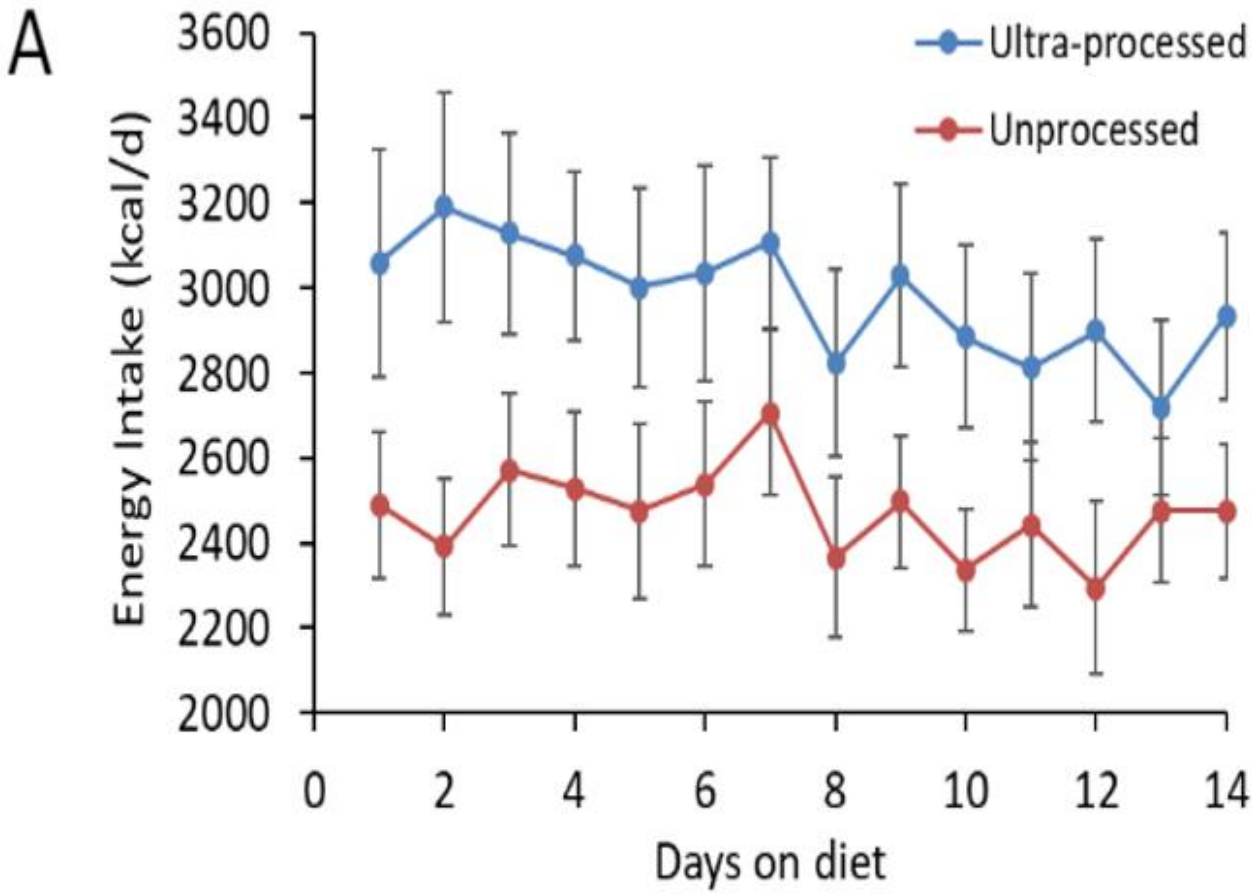
Daily Snacks

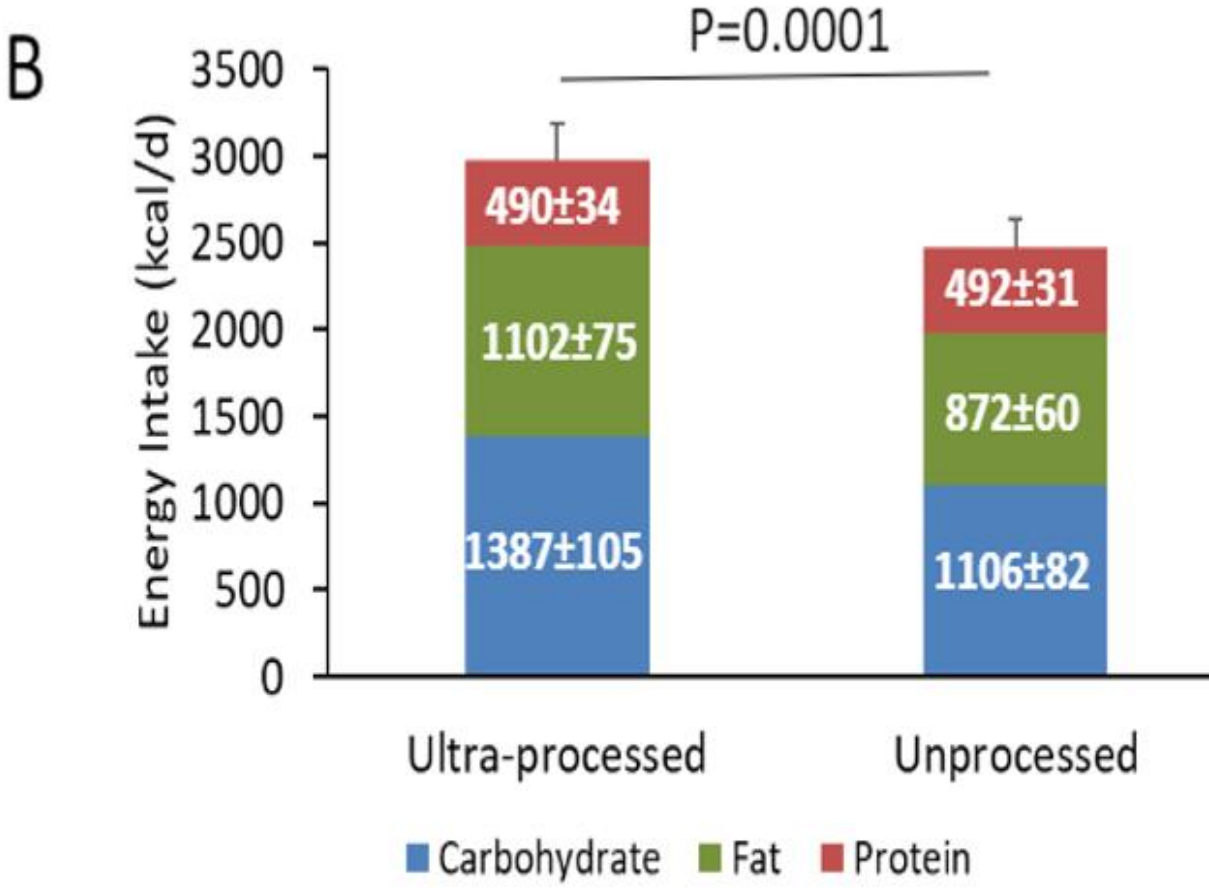
Baked Potato Chips (Lay's), Dry Roasted Peanuts (Planters), Cheese & Peanut Butter Sandwich Crackers (Keebler), Goldfish Crackers (Pepperidge Farm), Applesauce (Lucky Leaf).

Non ultra-processed Menu

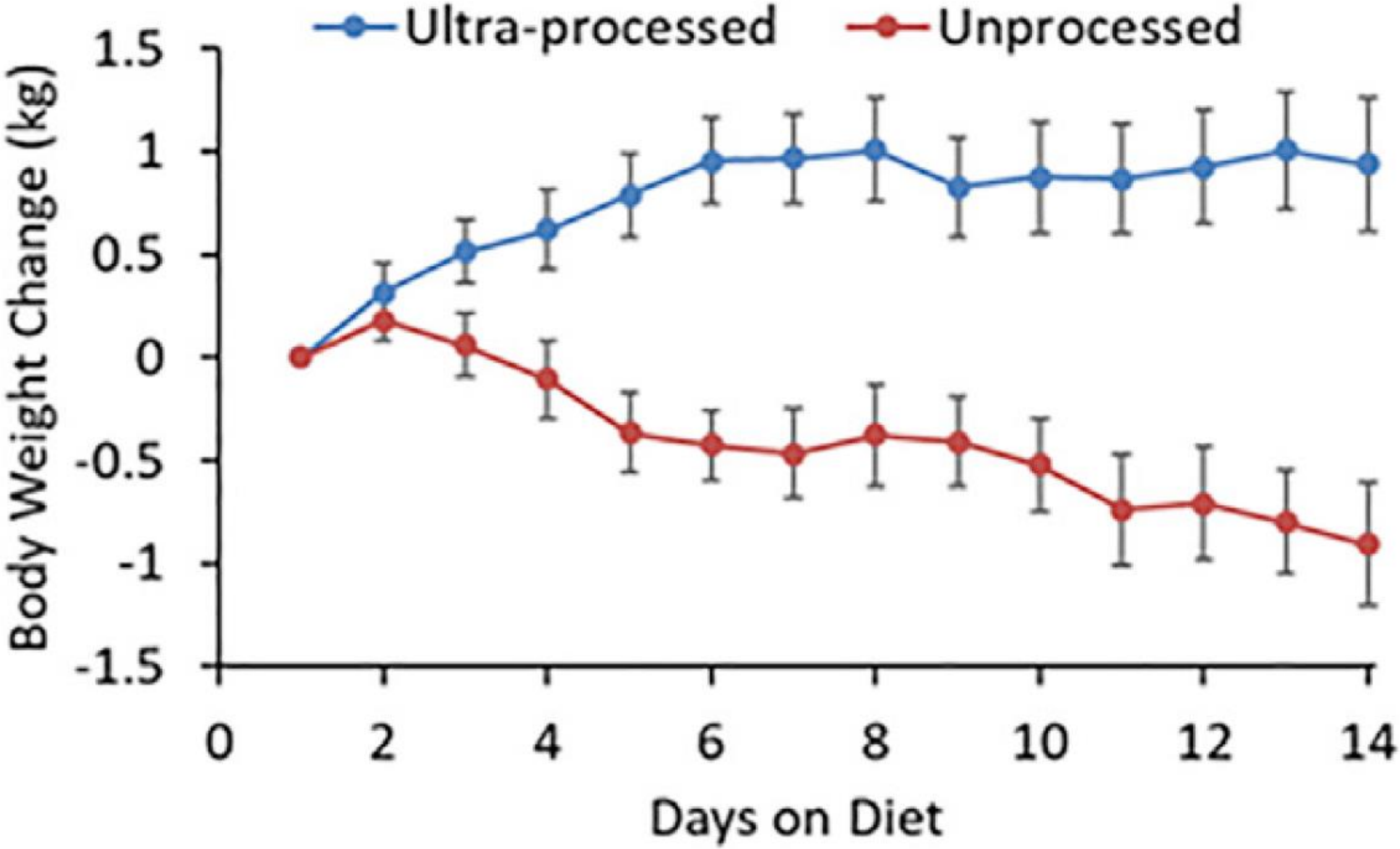
Daily Snacks

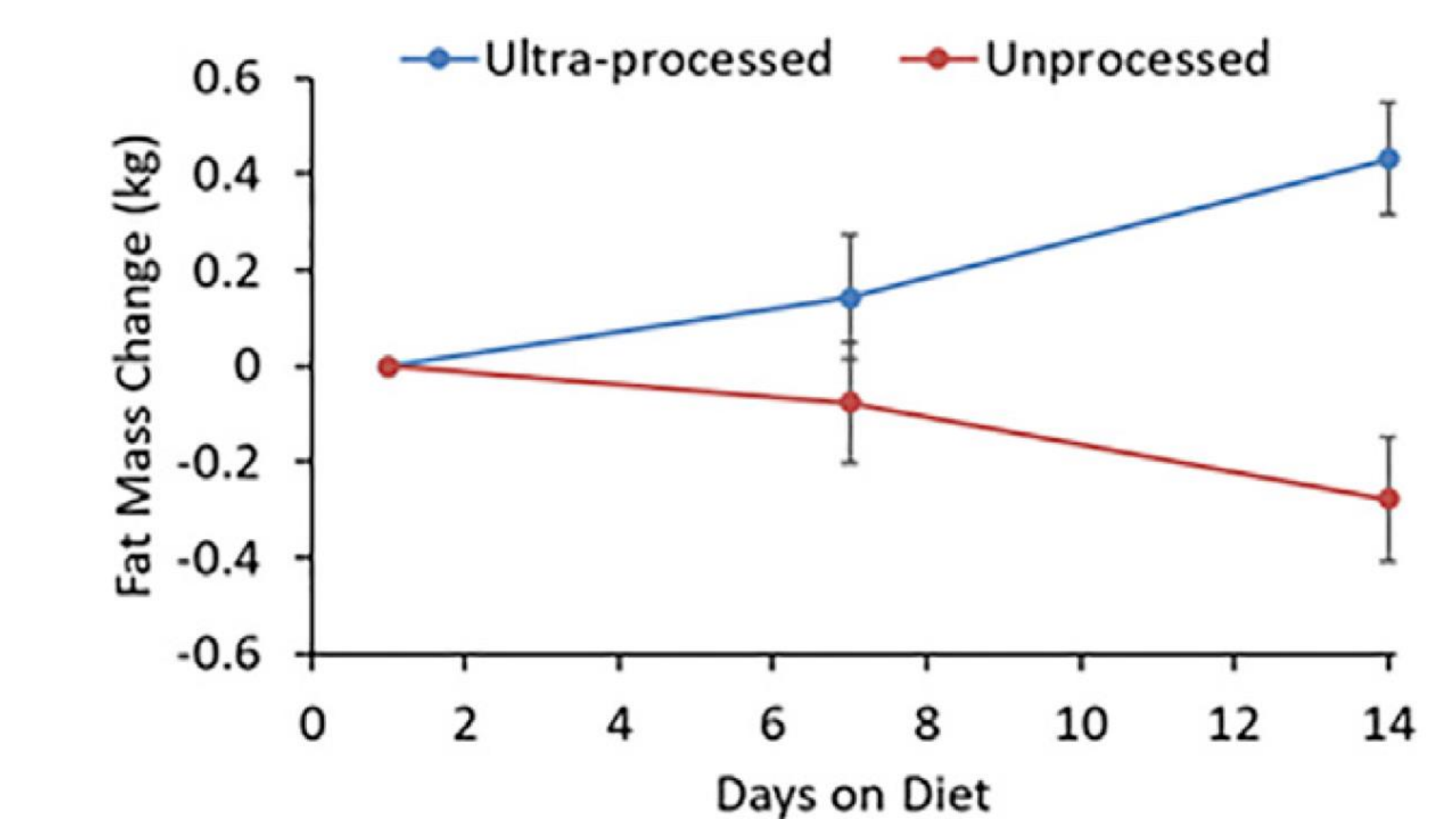
Fresh oranges and apples, raisins (Monarch), raw almonds (Giant), chopped walnuts (Diamond)

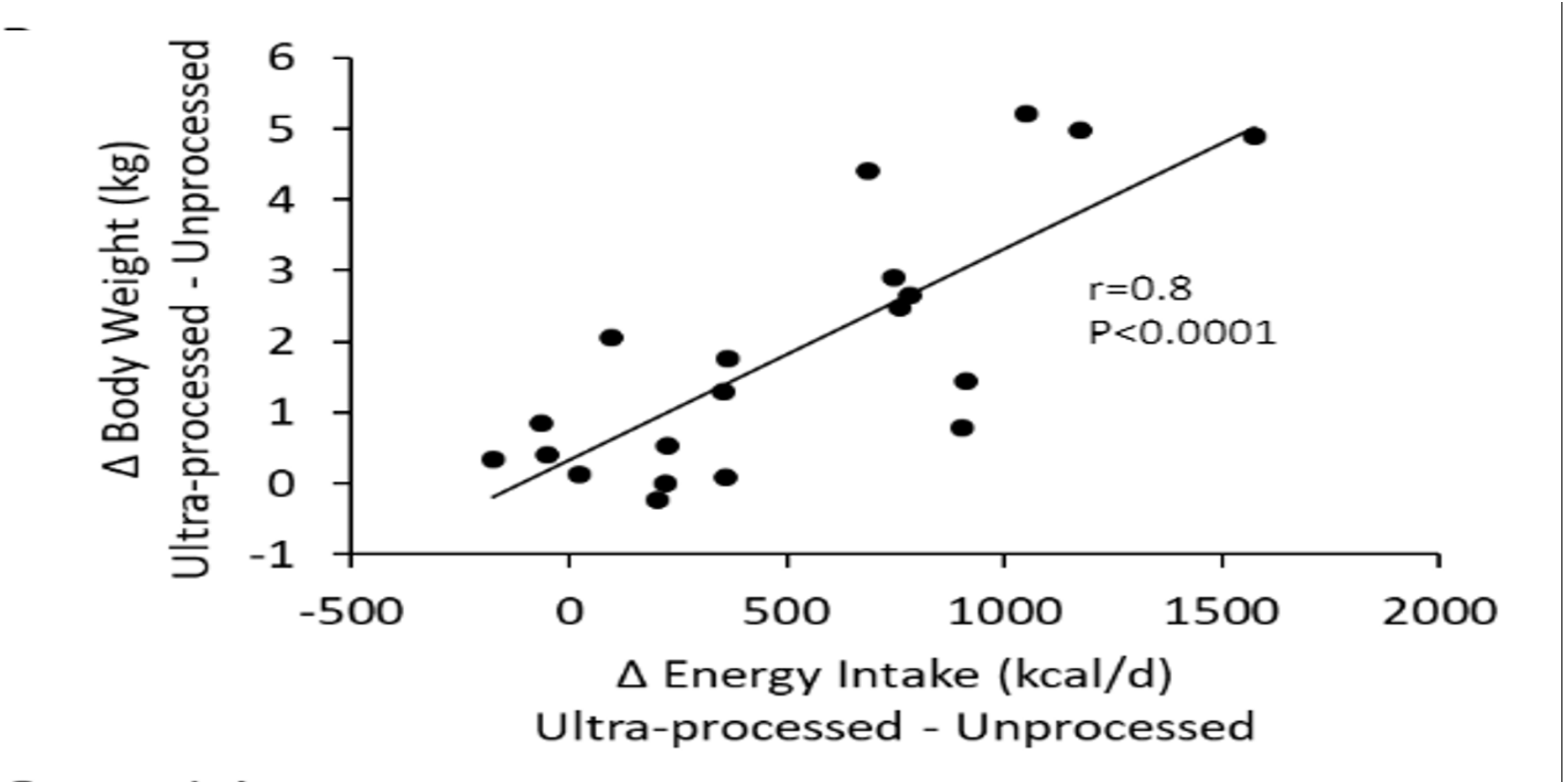




A) Energy intake was consistently higher during the ultra-processed diet. B) Average energy intake was increased during the ultra-processed diet because of increased intake of carbohydrate and fat, but not protein.

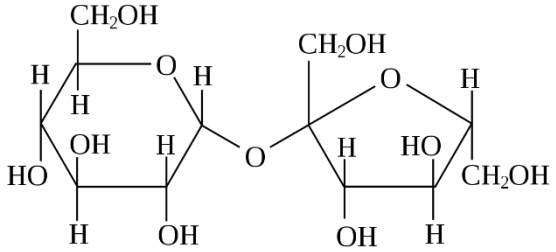

Ultra-processed
Unprocessed
Body Weight Change (kg)
1.5
1
0.5
0
-0.5
-1
-1.5
0
2
4
6
8
10
12
14
Days on Diet


Ultra-processed
Unprocessed
Fat Mass Change (kg)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0
2
4
6
8
10
12
14
Days on Diet

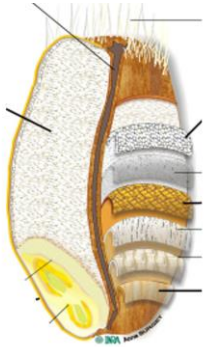


Differences in body weight change between the ultra-processed and unprocessed diets were highly correlated with the corresponding energy intake differences.

Are UPF harmful because of their unbalanced nutrient profile, or because 'acellular nutrients', or because of the way they are consumed, or because of additives, or because their effects on the microbiome, or …?



Nutrients



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(more than foods!)

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(when, where, how?)

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Actions and policies that are not working:

Nutrient-based guides and education
Misleading nutritional labelling
Cosmetic product reformulation
Marketing self-regulation

The real best buys:

Diet guides and nutrition education that promote real food and real meals

Fiscal policies that make real food and real meals more affordable than UPF

Warning labels and strong marketing restrictions on ALL UPF

A global framework convention on food systems


Many thanks!