Examining the Relationship Between Ultra-processed Food Consumption and Cardiometabolic Outcomes in Canadians

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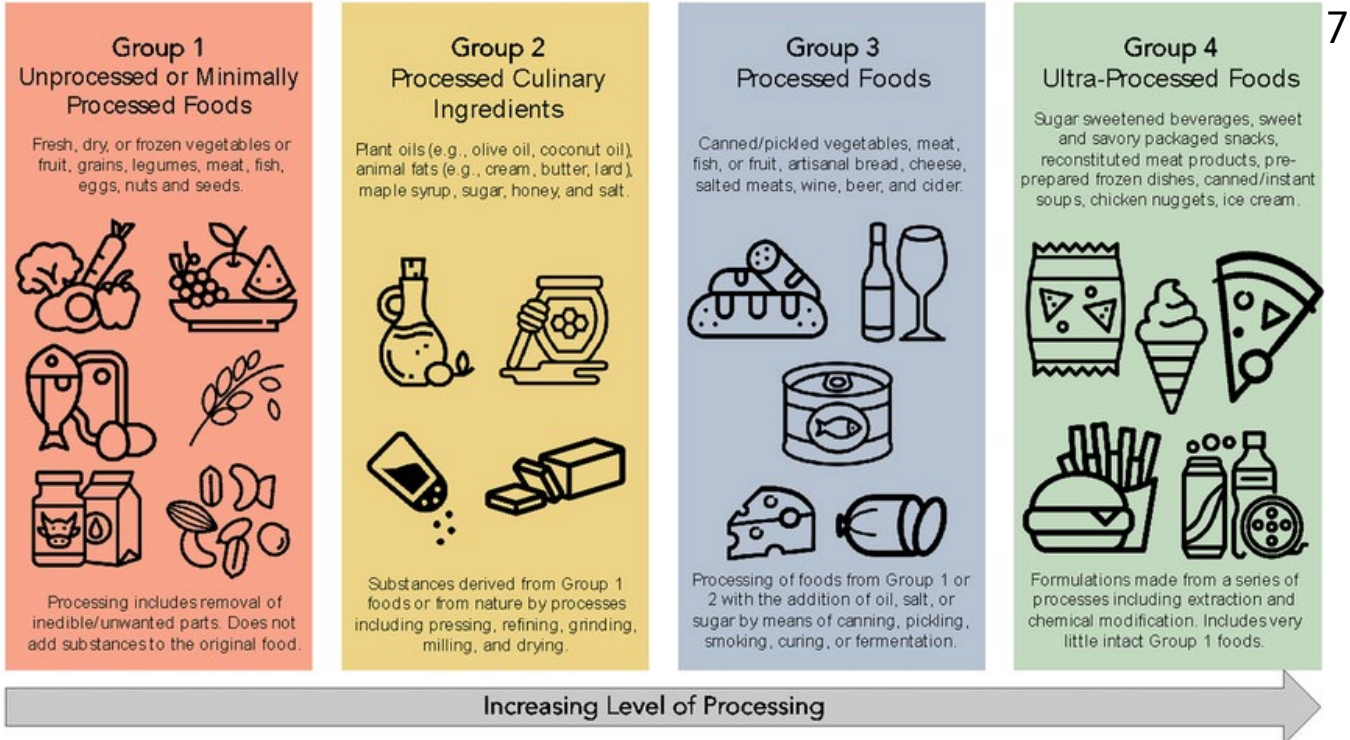
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Health of Canadian Adults

- **9 in 10** Canadians have at least one **risk factor** for cardiovascular disease or stroke[1]

- **1 in 5** Canadians have **metabolic syndrome** in 2010[2]

- **1 in 3** Canadians are **obese** in 2022[3]

- A considerable number of **deaths could be averted** or delayed if Canadians adhered to **dietary recommendations**[4]

- **Over half of total energy intake** came from ultra-processed food (UPF) sources for Canadians in 2015 and was associated with poorer diet quality and increased energy intake[5,6]

Ultra-Processed Foods

Multi-ingredient, industrially formulated, and contain little to no whole foods[5]

NOVA CLASSIFICATION

Group 1
Unprocessed or Minimally Processed Foods

Fresh, dry, or frozen vegetables or fruit, grains, legumes, meat, fish, eggs, nuts and seeds.

Processing includes removal of inedible/unwanted parts. Does not add substances to the original food.

Group 2
Processed Culinary Ingredients

Plant oils (e.g., olive oil, coconut oil), animal fats (e.g., cream, butter, lard), maple syrup, sugar, honey, and salt.

Substances derived from Group 1 foods or from nature by processes including pressing, refining, grinding, milling, and drying.

Group 3
Processed Foods

Canned/pickled vegetables, meat, fish, or fruit, artisanal bread, cheese, salted meats, wine, beer, and cider.

Processing of foods from Group 1 or 2 with the addition of oil, salt, or sugar by means of canning, pickling, smoking, curing, or fermentation.

Group 4
Ultra-Processed Foods

Sugar sweetened beverages, sweet and savory packaged snacks, reconstituted meat products, pre-prepared frozen dishes, canned/instant soups, chicken nuggets, ice cream.

Formulations made from a series of processes including extraction and chemical modification. Includes very little intact Group 1 foods.

Increasing Level of Processing

Ultra-Processed Foods

Prior research from the 2015 Canadian Community Health Survey – Nutrition (CCHS-N) has demonstrated an **association between UPF and disease status**[8]

UPF Consumption

Obesity
Type 2 Diabetes
Hypertension

Ultra-Processed Foods

Research from other jurisdictions has begun to implicate **UPF in the rise of poor cardiometabolic profiles.**[9,10]

UPF Consumption

Body Composition
Blood Pressure
Inflammatory Markers
Lipid Profiles
Glycemic Markers

Objective: examine the relationships between **UPF** consumption and **cardiometabolic** health using a nationally representative sample of Canadians

Methods: CHMS

Canadian Health Measures Survey (CHMS)[11] → Health history, health-related lifestyle behaviours, biomarkers of health

Sample: Canadians aged **3-79** living in the 10 provinces

Exclusion Criteria: persons living on Aboriginal reserves, full-time members of the Canadian forces, residents of certain remote regions

Sampling Strategy: stratified three-stage sample, with one or two individuals randomly selected from each dwelling in a selected site

Cycle 5 (2016/2017) and Cycle 6 (2018/2019) → n=6517

Methods: CHMS

Canadian Health Measures Survey (CHMS)

1 **Household questionnaire**: sociodemographic variables, lifestyle behaviours, movement behaviours, general health/disease status, dietary data

2 **Clinic visit**: anthropometric measures, blood pressure and heart rate, blood samples, urine samples, fitness testing, accelerometry

Methods: Data

Predictor Variables

1. Dietary data collected by **food frequency questionnaire**
2. NOVA classification to classify foods as **UPF or not**
3. Number of **UPF servings per day** arranged into **quartiles**

Outcome Variables

Body mass index (BMI)

Self-rated health

Systolic BP (SBP), diastolic BP (DBP)

Total cholesterol (TC), high-density lipoprotein (HDL), TC:HDL, glucose, HBA1C, c-reactive protein (CRP), white blood cell (WBC)

Fasting subsample: triglycerides (TAG), low-density lipoprotein (LDL)

Confounding Variables

Age, sex, race, highest level of household education, household income (quartiles)

mCAFT score

BMI

Statistical Analyses

TO ASSESS **DIFFERENCES BETWEEN QUARTILES** OF UPF:

Chi-square tests for categorical outcomes

ANOVA for continuous outcomes

TO ASSESS THE **ASSOCIATION BETWEEN OUTCOMES AND UPF** QUARTILES:

Multivariable linear regression

  Controlling for: age, sex, income quartile, education, race, BMI (for non-BMI variables), fitness

*all analyses were weighted and bootstrapped using combined C5/6 weight file.

Findings

UPF servings per day:

1.2 in the LOWEST quartile and **5.8** in the HIGHEST quartile

Higher UPF consumption among:

Males

19-30 yrs

Lowest income quartile
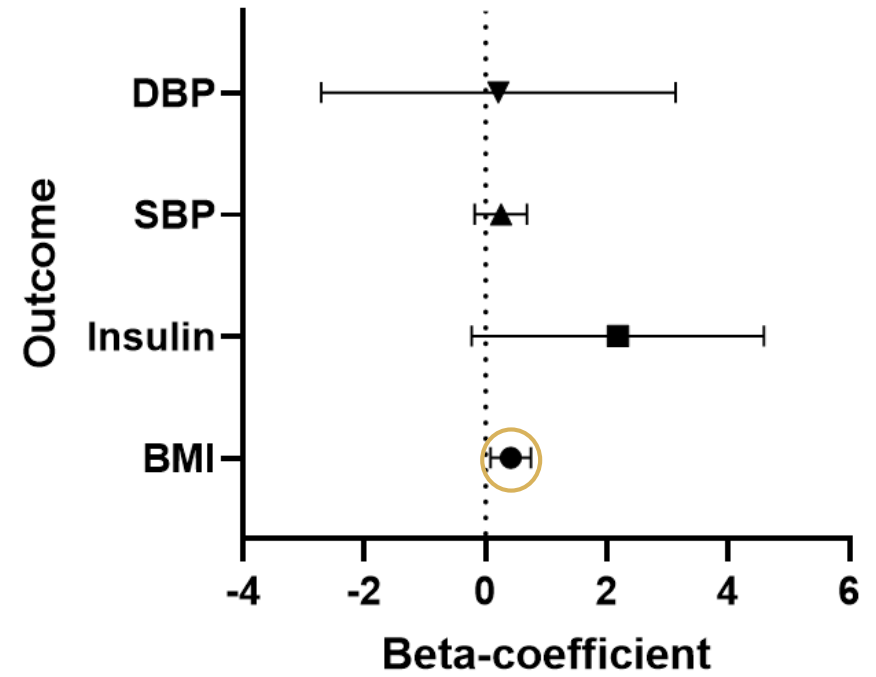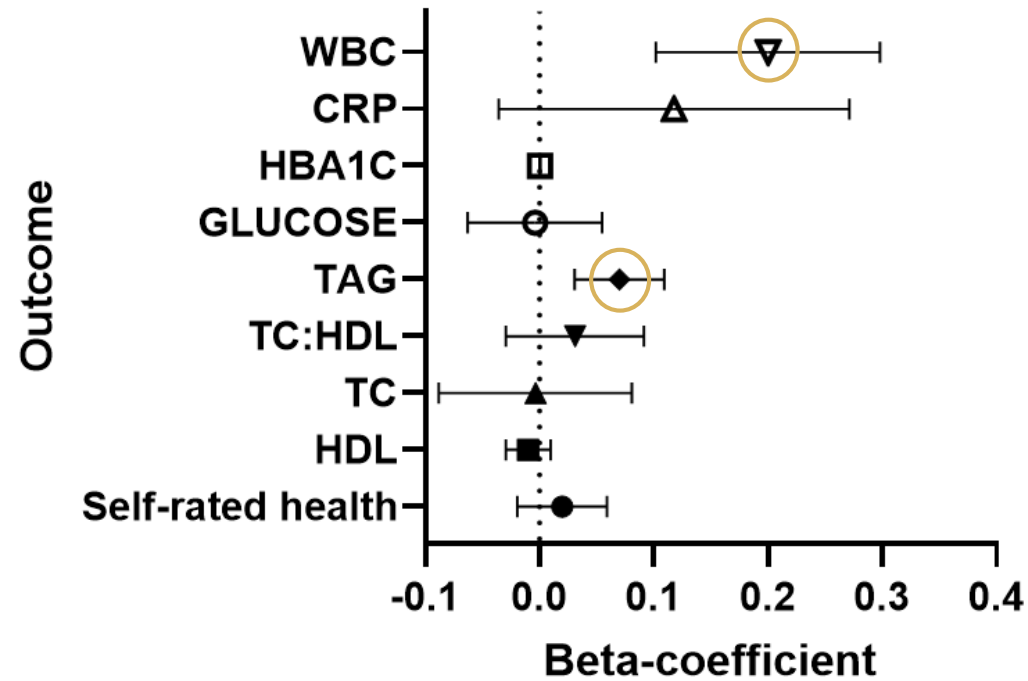
Black or White

Less education

Higher PA levels

Findings
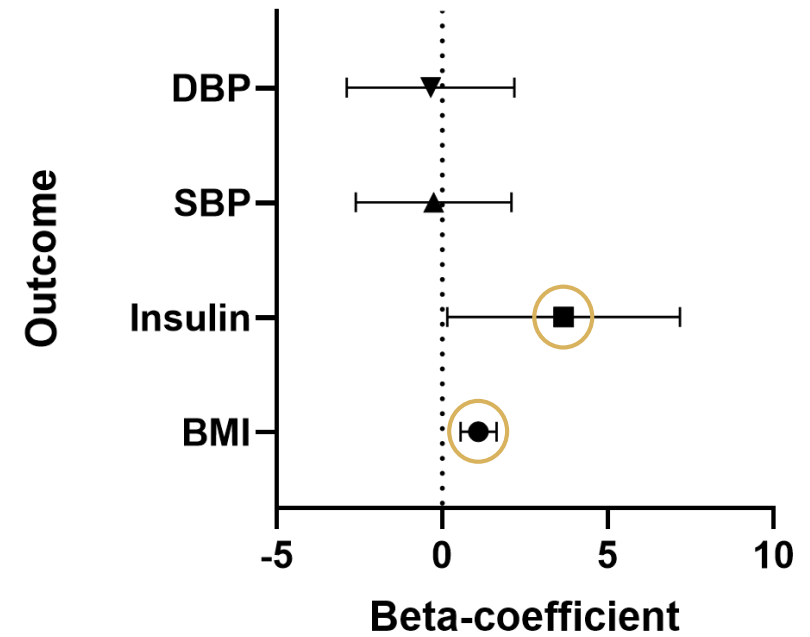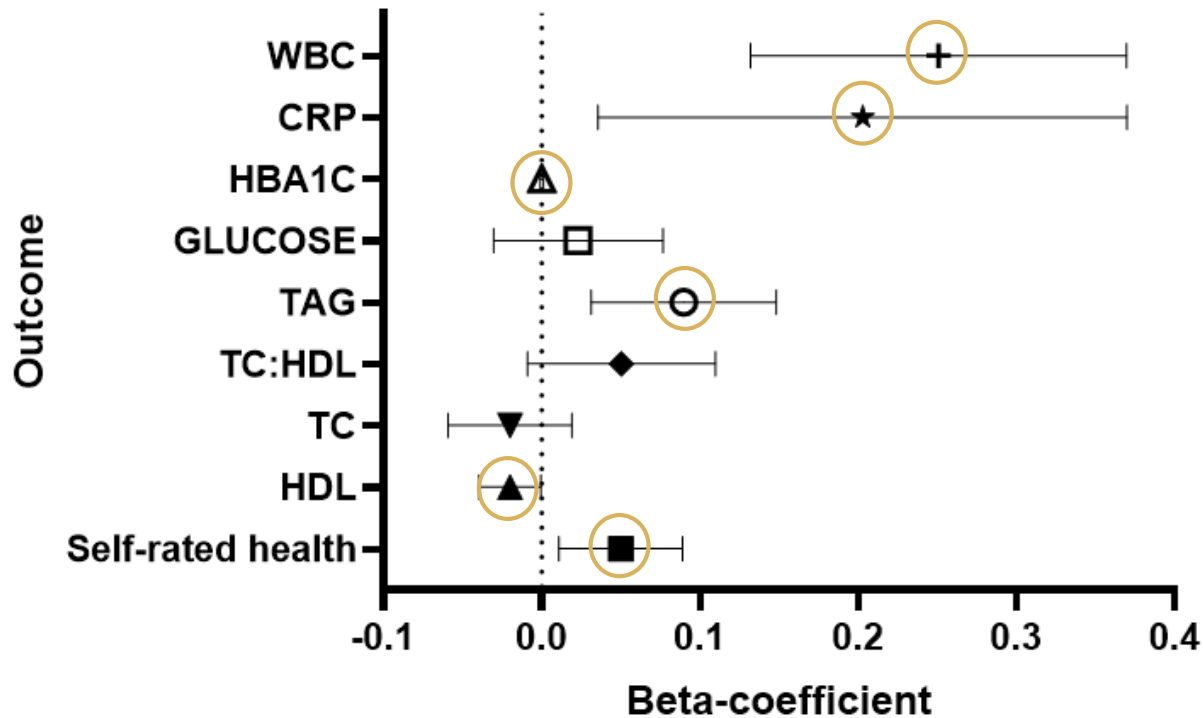
Figures 1 & 2: Forest plot displaying beta-coefficients for linear regression of UPF quartiles and health outcomes after adjustment for age, sex, income, race, and education

Findings

Figures 3 & 4: Forest plot displaying beta-coefficients for linear regression of UPF quartiles and health outcomes after adjustment for age, sex, income, race, education, BMI, and fitness

Discussion

Increasing quartiles of UPF consumption are associated with significantly higher **BMI, TAG, fasting insulin, HbA1C, CRP, WBC** and lower **self-rated health and HDL.**

Most are likely explained by **poor nutrient content**[12]

WBC and **CRP** are an indication of inflammation – **detecting invaders**!!![13]

link to other health outcomes?[14]

Although not significant, there is an increasing trend for **glucose and TC:HDL** across increasing UPF quartiles.

BMI and **fitness** may play **mediating** and **moderating** roles in the development of poor health outcomes with increasing UPF consumption.

Significance and Implications

These findings will provide important **perspectives** inform current **recommendations and guidelines** for leading healthy lifestyles.

These findings will serve to inform **Canadian food policies** which have so far focused on **restricting single nutrients** of public health concern.

Limitations

FFQ

Cross-sectional data

References

1. Connected by the numbers. Heart and Stroke Foundation of Canada. Accessed May 12, 2024. https://www.heartandstroke.ca/en/articles/connected-by-the-numbers/

2. Setayeshgar S, Whiting SJ, Vatanparast H. Metabolic syndrome in canadian adults and adolescents: prevalence and associated dietary intake. *ISRN Obes*. 2012;2012:816846. Published 2012 Nov 20. doi:10.5402/2012/816846

3. Government of Canada SC. An overview of weight and height measurements on World Obesity Day. Published March 4, 2024. Accessed May 12, 2024. https://www.statcan.gc.ca/o1/en/plus/5742-overview-weight-and-height-measurements-world-obesity-day

4. Bélanger M, Poirier M, Jbilou J, Scarborough P. Modelling the impact of compliance with dietary recommendations on cancer and cardiovascular disease mortality in Canada. *Public Health*. 2014;128(3):222-230. doi:10.1016/j.puhe.2013.11.003

5. Polsky JY, Moubarac JC, Garriguet D. Consumption of ultra-processed foods in Canada. *Health Rep.* 2020;31(11):3-15. doi:10.25318/82-003-x202001100001-eng

6. Moubarac JC, Batal M, Louzada ML, Martinez Steele E, Monteiro CA. Consumption of ultraprocessed foods predicts diet quality in Canada. *Appetite*. 2017;108:512-520. doi:10.1016/j.appet.2016.11.006

7. Crimarco A, Landry MJ, Gardner CD. Ultra-processed Foods, Weight Gain, and Co-morbidity Risk. Curr Obes Rep. 2022;11(3):80-92. doi:10.1007/s13679-021-00460-y

8. Nardocci M, Polsky JY, Moubarac JC. Consumption of ultra-processed foods is associated with obesity, diabetes and hypertension in Canadian adults. *Can J Public Health*. 2021;112(3):421-429. doi:10.17269/s41997-020-00429-9

9. Mambrini SP, Menichetti F, Ravella S, et al. Ultra-Processed Food Consumption and Incidence of Obesity and Cardiometabolic Risk Factors in Adults: A Systematic Review of Prospective Studies. *Nutrients*. 2023;15(11):2583. Published 2023 May 31. doi:10.3390/nu15112583

10. Pagliai G, Dinu M, Madarena MP, Bonaccio M, Iacoviello L, Sofi F. Consumption of ultra-processed foods and health status: a systematic review and meta-analysis. *British Journal of Nutrition*. 2021;125(3):308-318. doi:10.1017/S0007114520002688

11. Government of Canada SC. Canadian health measures survey (CHMS). Government of Canada, Statistics Canada. June 28, 2023. Accessed November 28, 2023. https://www.statcan.gc.ca/en/survey/household/5071.

12. Poti JM, Braga B, Qin B. Ultra-processed Food Intake and Obesity: What Really Matters for Health-Processing or Nutrient Content?. *Curr Obes Rep*. 2017;6(4):420-431. doi:10.1007/s13679-017-0285-4

13. Tristan Asensi M, Napoletano A, Sofi F, Dinu M. Low-Grade Inflammation and Ultra-Processed Foods Consumption: A Review. *Nutrients*. 2023;15(6):1546. Published 2023 Mar 22. doi:10.3390/nu15061546

14. Contreras-Rodriguez O, Reales-Moreno M, Fernández-Barrès S, et al. Consumption of ultra-processed foods is associated with depression, mesocorticolimbic volume, and inflammation. *J Affect Disord*. 2023;335:340-348. doi:10.1016/j.jad.2023.05.009