

Ma y 16th, 2024

De p a r t m e n t o f K i n e s i o l o g y

Mc M a s t e r U n i v e r s i t y

Exa m i n i n g p u r c h a s e s o f V i t a m i n D
f o r t i f i e d f o o d s a c r o s s
s o c i o d e m o g r a p h i c g r o u p s

An e x a m i n a t i o n o f t h e C a n a d i a n S u r v e y o f H o u s e h o l d S p e n d i n g

STUDENT

Annika Bauer

SUPERVISOR

Dr. Anthea Christoforou



1 in 5 Canadians have inadequate intake of Vitamin D

8% of population at risk for deficiency

Risk of bone softening and deformation

Vitamin D Fortification Policies

Food	Amount	Status
Cow's Milk	2 μ g / 100ml	Mandatory
Goat's Milk	2 μ g / 100ml	Mandatory
Margarine	26 μ g / 100g	Mandatory
Plant-based beverages	2 μ g / 100ml	Voluntary
Yogurt	5 μ g / 100ml	Proposed
Ke fir	2.7 μ g / 100ml	Proposed

81% of Canadians consume Milk and 54% of Canadians consume margarine
according to Health Canada

Sociodemographic groups with lower milk consumption

↓ Education

↓ Income

↑ Age

Non-White Ethnicity

Limitations of previous research

Few studies

Primary focus on milk

Old data sets

Data prone to recall bias



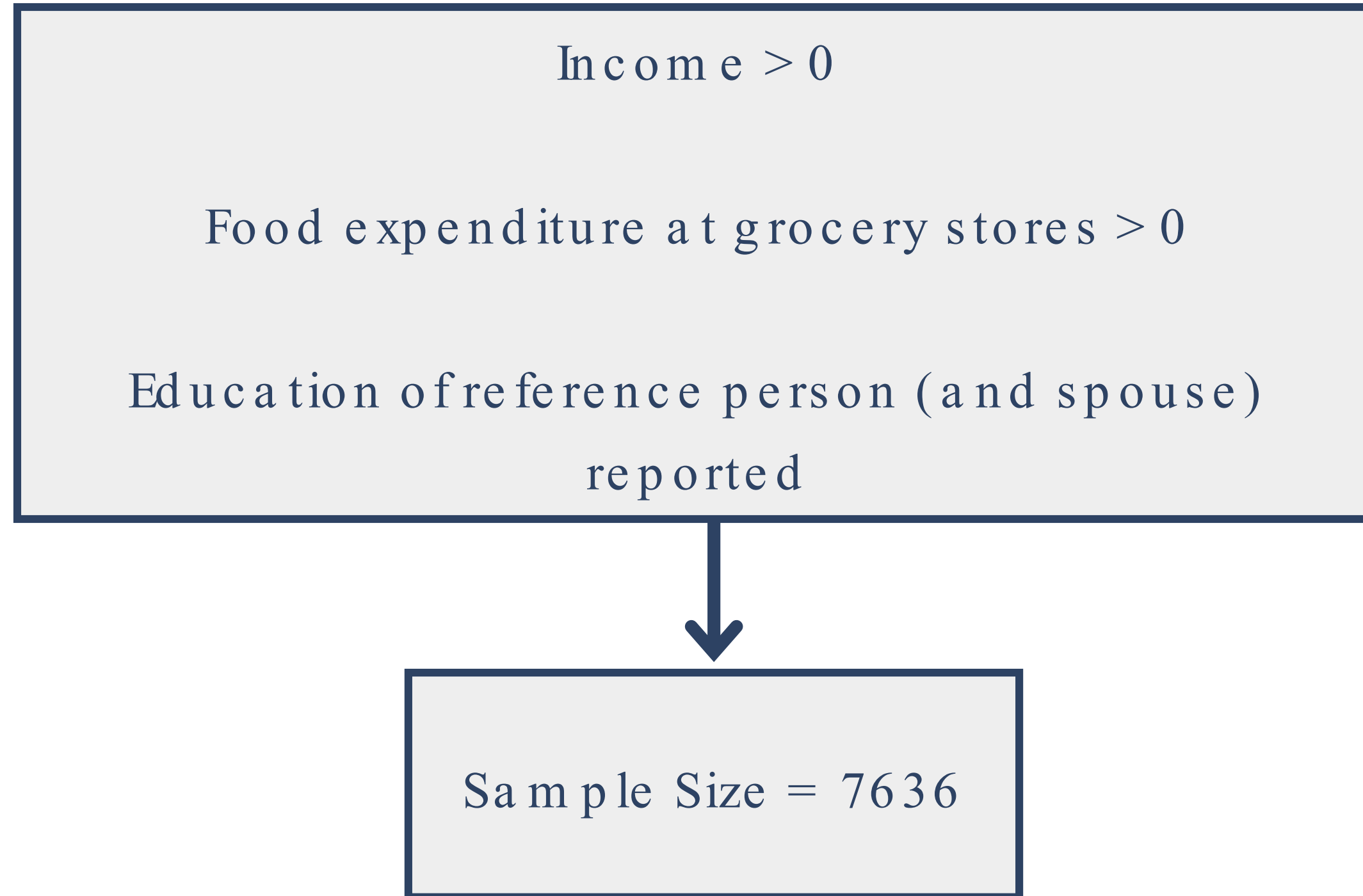
Aim

Explore the differences in exposure to vitamin D fortified foods across various socioeconomic axes using household expenditure data

Survey of Household Spending 2019

	Provinces	Territorial Capitals
Sampling Design	Two-Stage	One-Stage
Households Sampled	17,491	937
Interview completed	10,890	590
Diary Completed	7,566	364

Excluding residents of institutions, members of the Canadian Forces living in military camps and people living on First Nations reserves

Inclusion Criteria

Outcome Variables

Purchasing behaviour

Purchasing / not
purchasing

Expenditure Share

= (Expenditure on
Item / Total Food
Expenditure) x 100

Explanatory variables

Income

< 50,000
50,000 - 100,000
100,000 - 150,000
>150,000

Education

Highest level between
reference person and
spouse

Children U15

Proportion of children
under 15

Controls

Household Size

Number of Persons in
Household

Restaurant Expenditure

Spending in CAD

Statistical Analysis with SAS/PC Version 9.4

Proportions (%)

Proportion of households purchasing Vit D fortified foods



Multiple logistic regression

Relationship of purchasing behavior and sociodemographic factors

Means (SD)

Mean expenditure shares of Vit D fortified foods



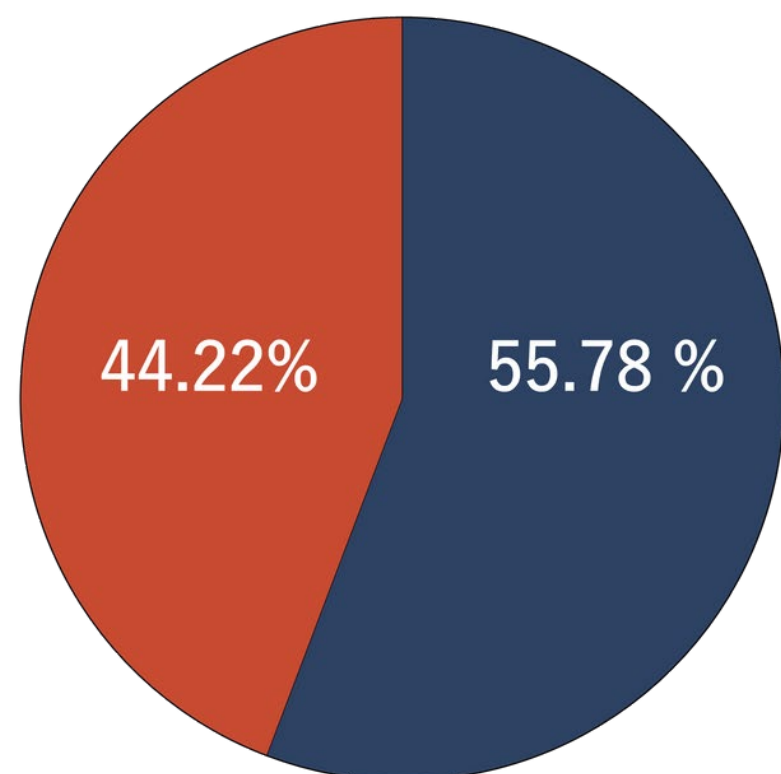
Multiple linear regression

Relationship between budgetary share & sociodemographic factors

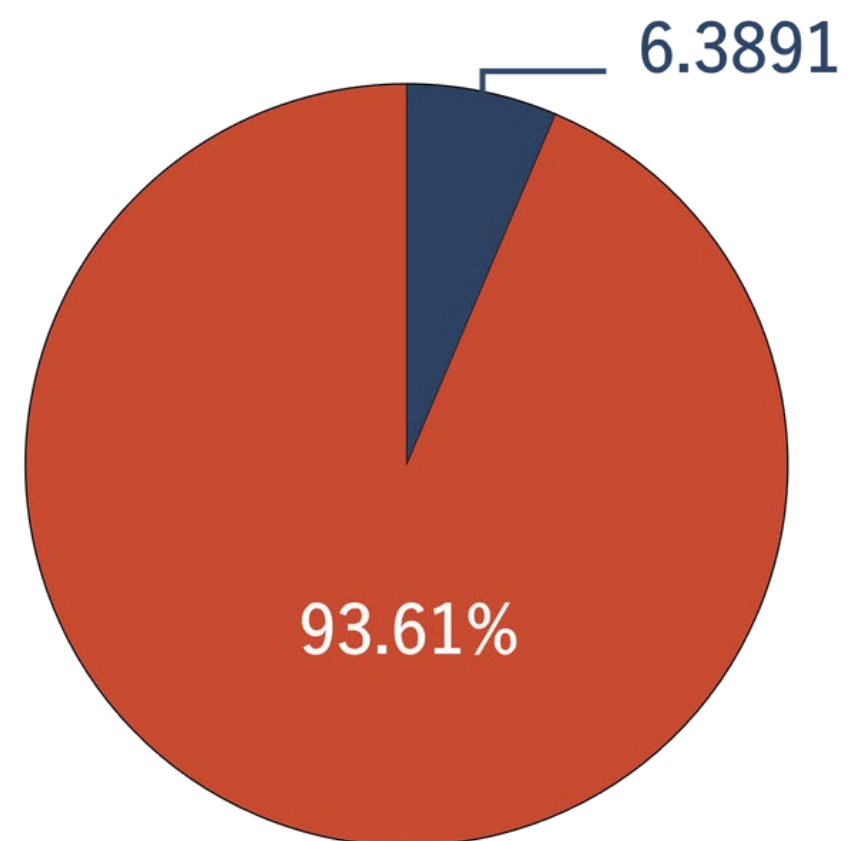
Weights and bootstrap weights applied

Proportion of Households Purchasing

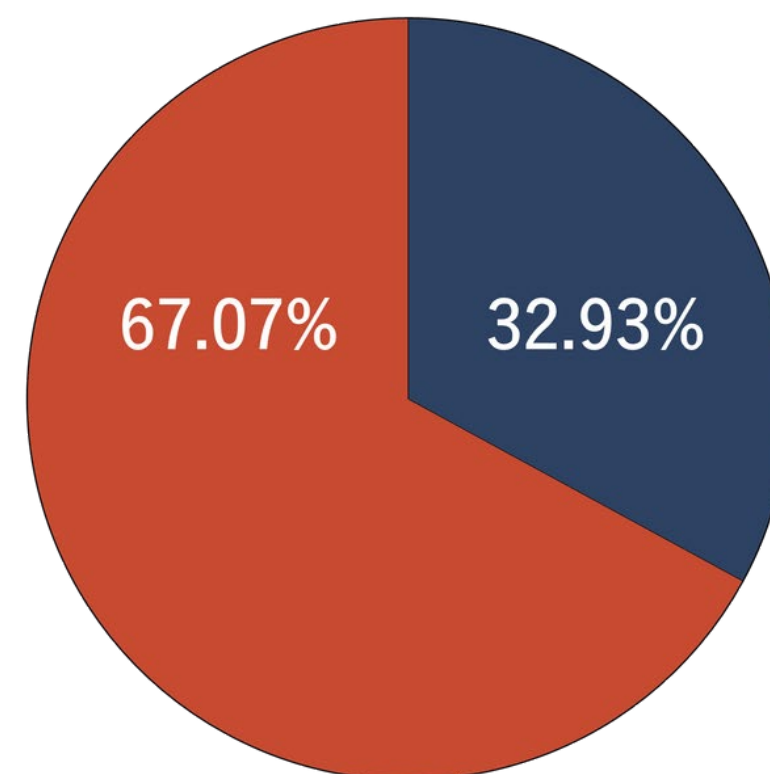
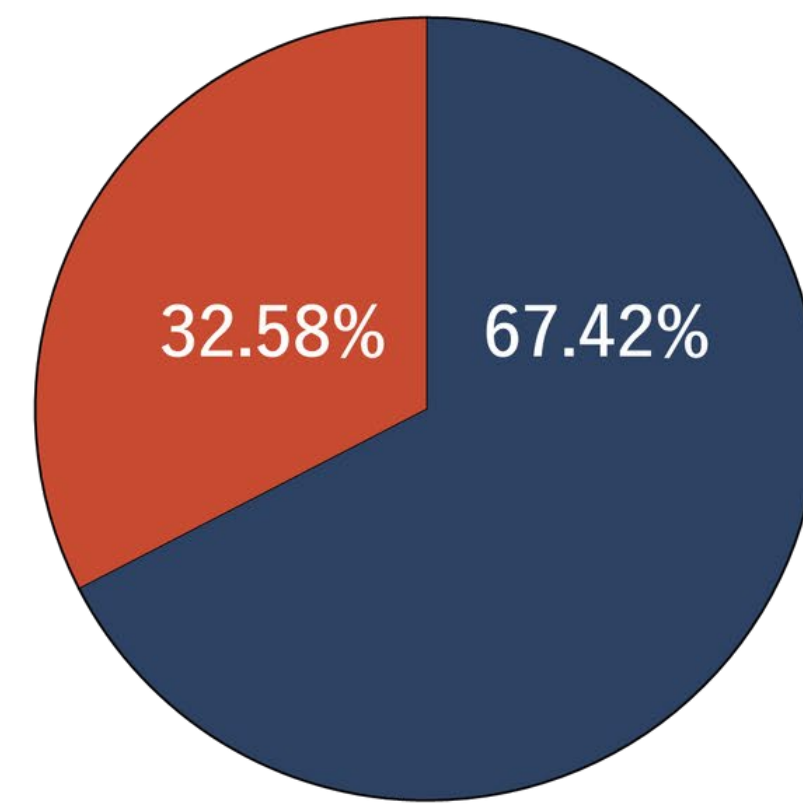
Milk



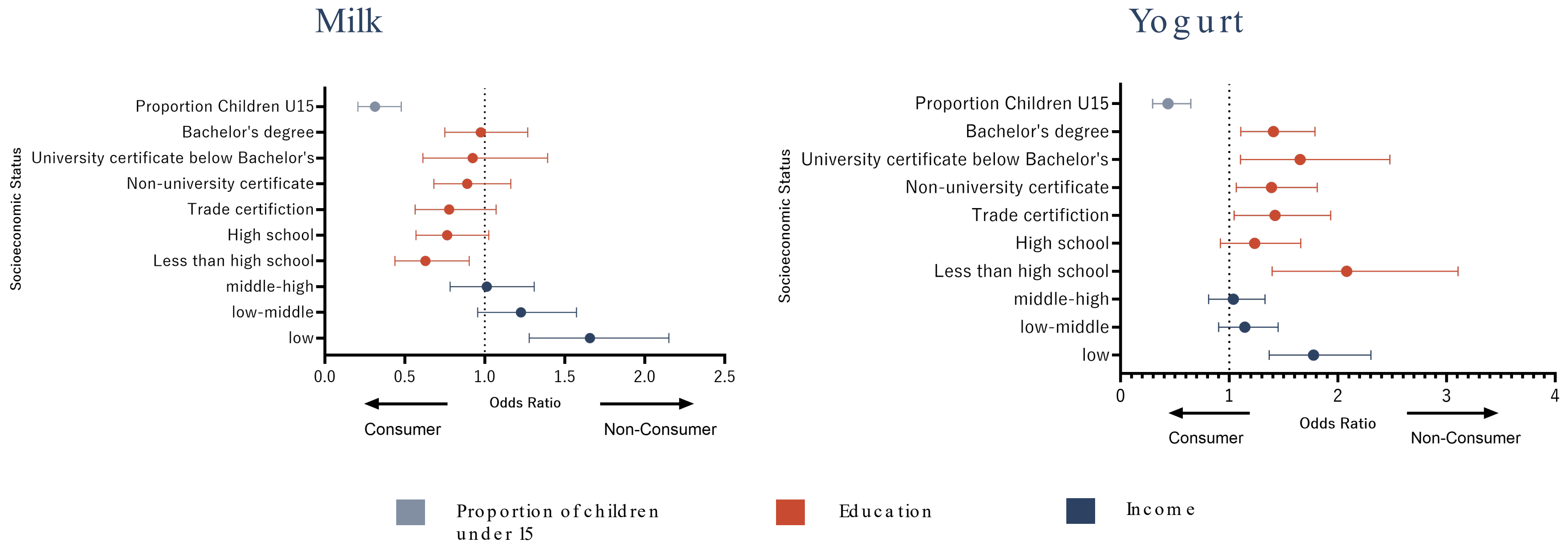
Ma rg a r i n e



Yogurt

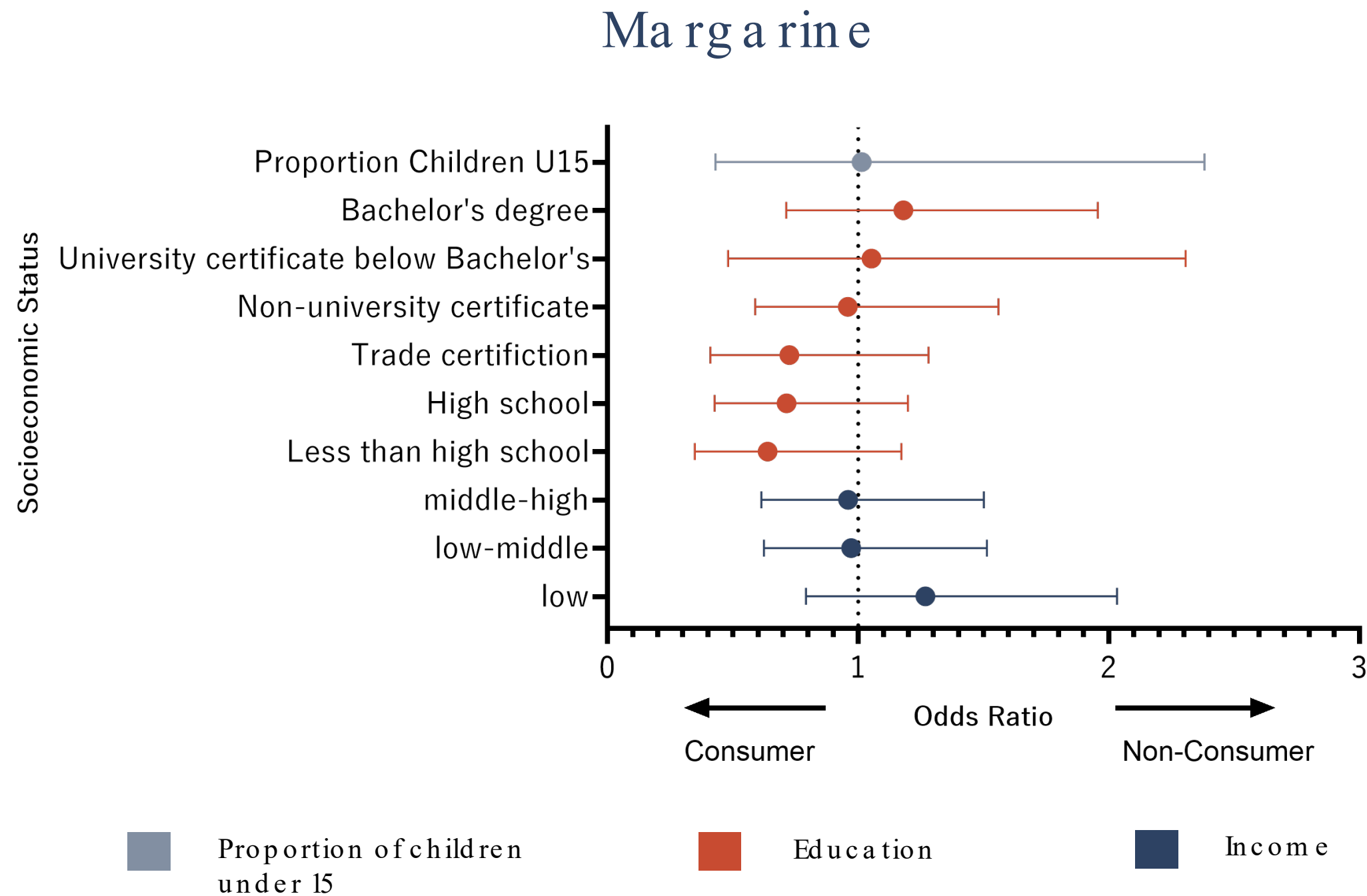
At least one
VD Fortified Food

Impact of Socioeconomic Status on Purchasing Behaviour*



*Logistic regression models adjusted for household size and expenditure at restaurants. Highest income and education groups were used as reference categories.

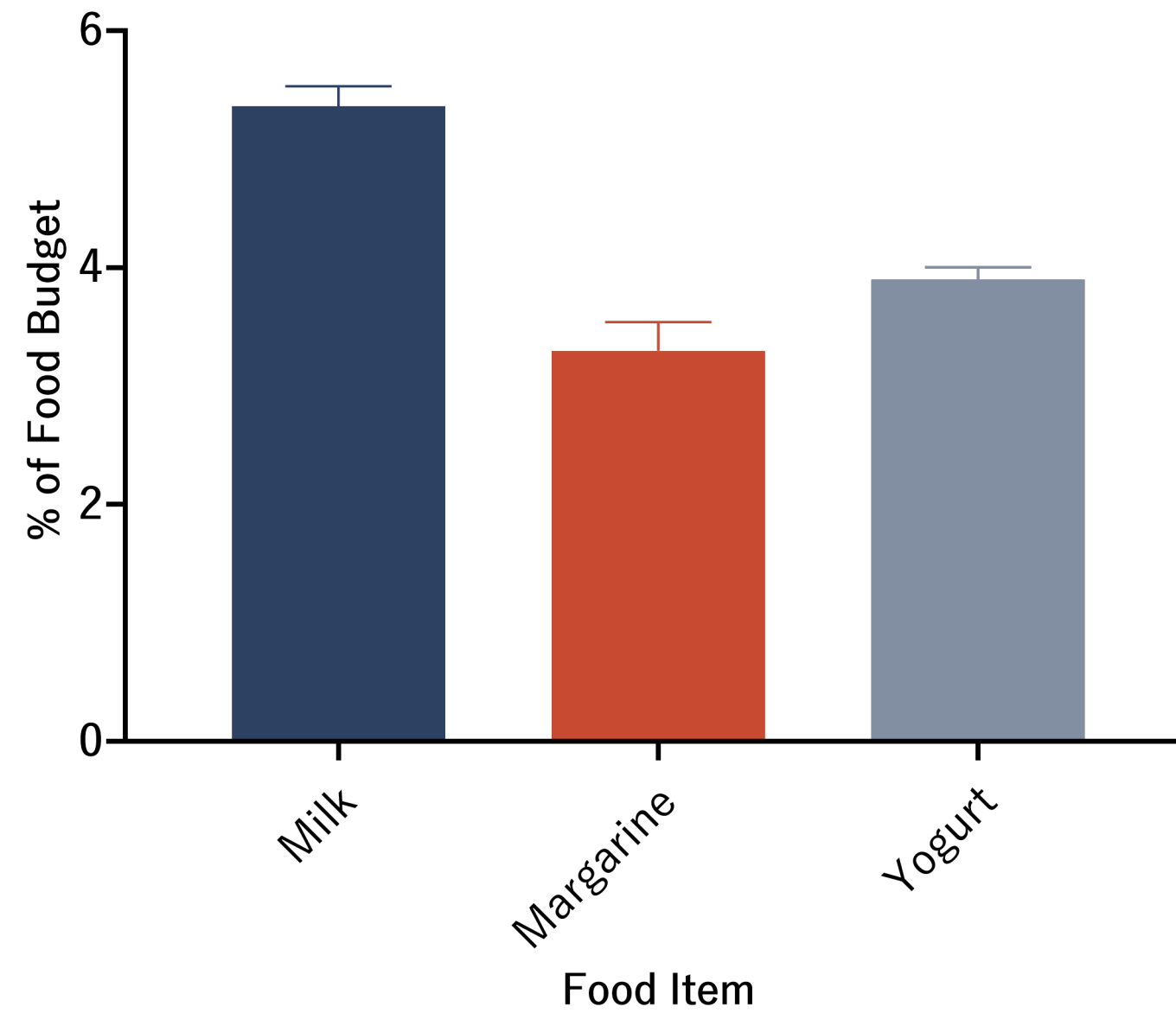
Impact of Socioeconomic Status on Purchasing Behaviour*



*Logistic regression models adjusted for household size and expenditure at restaurants. Highest income and education groups were used as reference categories.

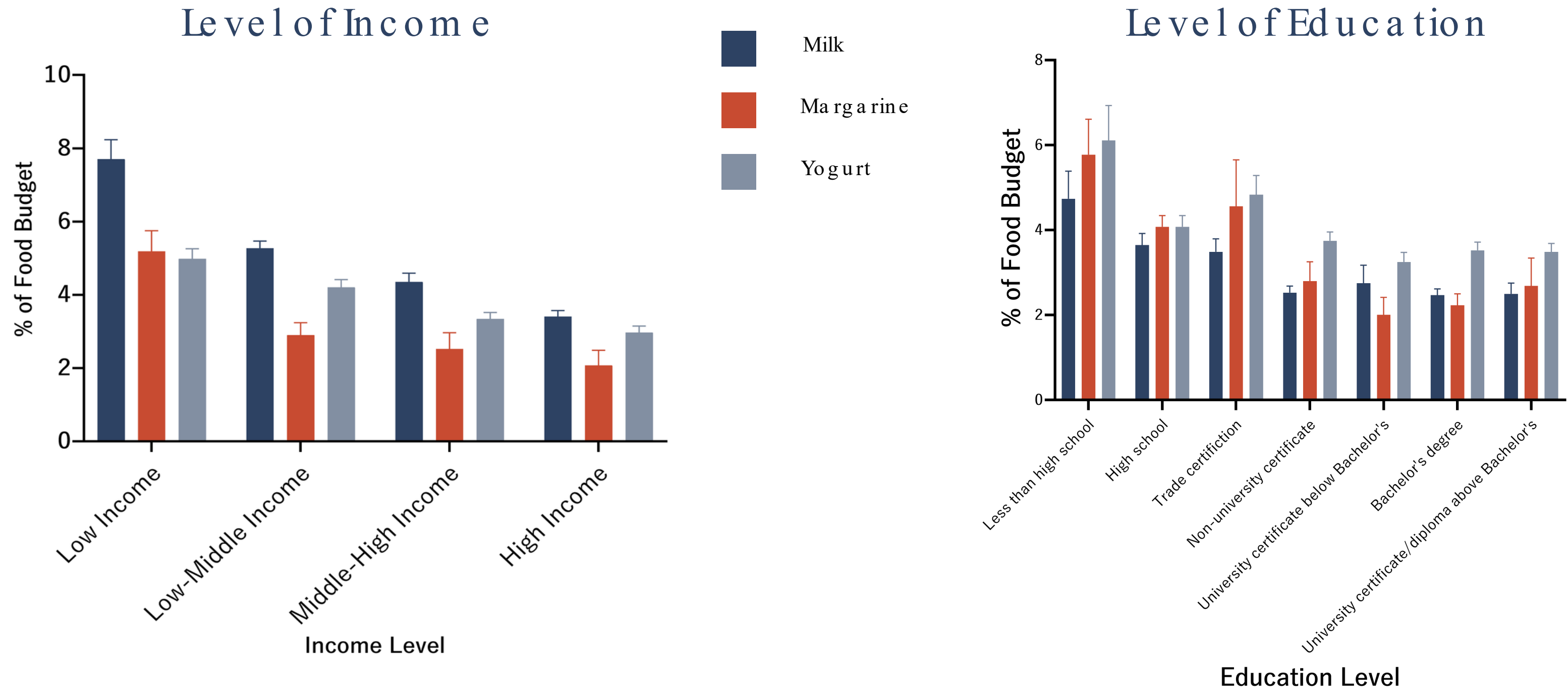
Mean Expenditure Shares for Vitamin D Fortified Foods*

Across all Households



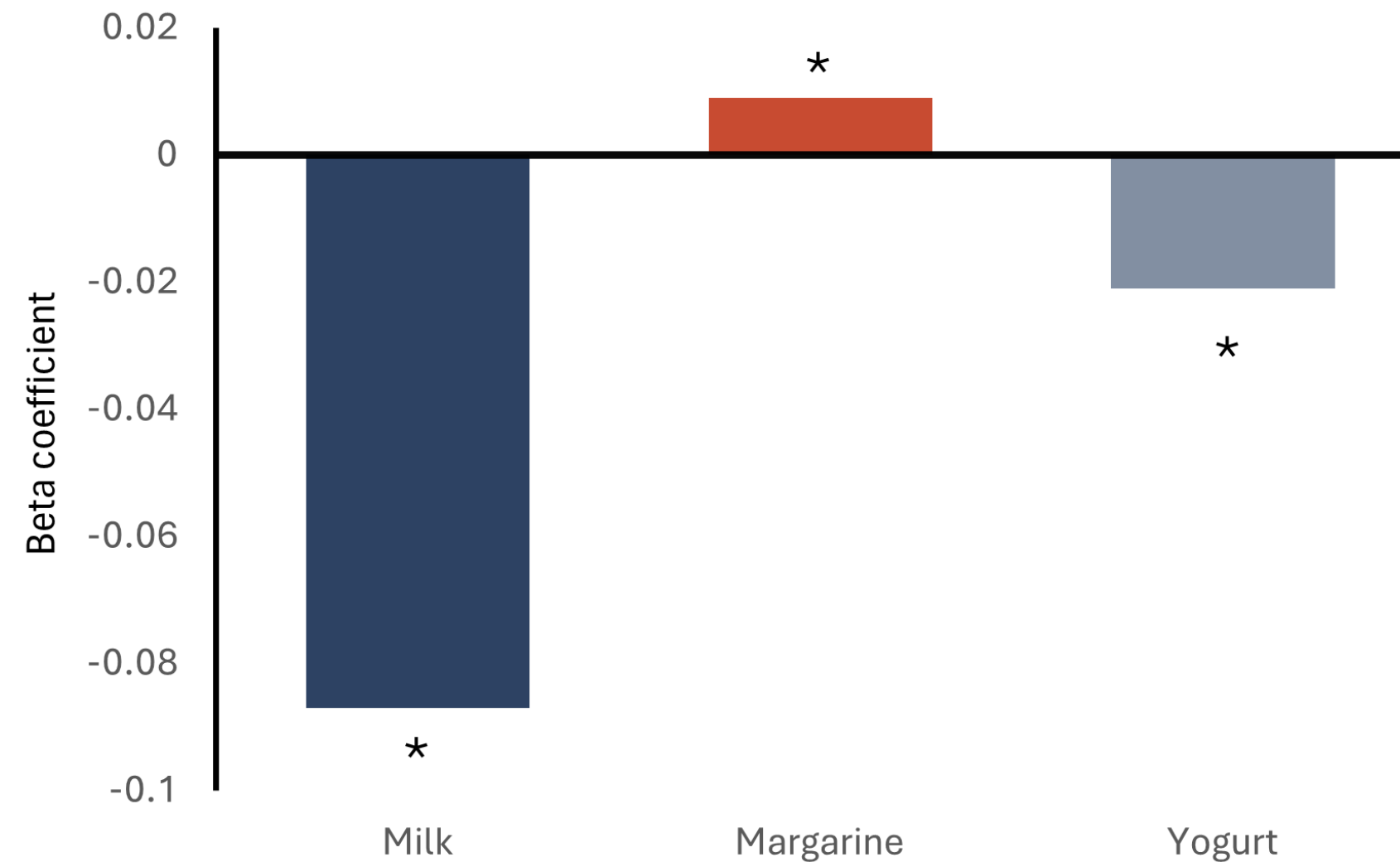
* Error bars denote standard deviations.

Mean Expenditure Shares for Vitamin D Fortified Foods*



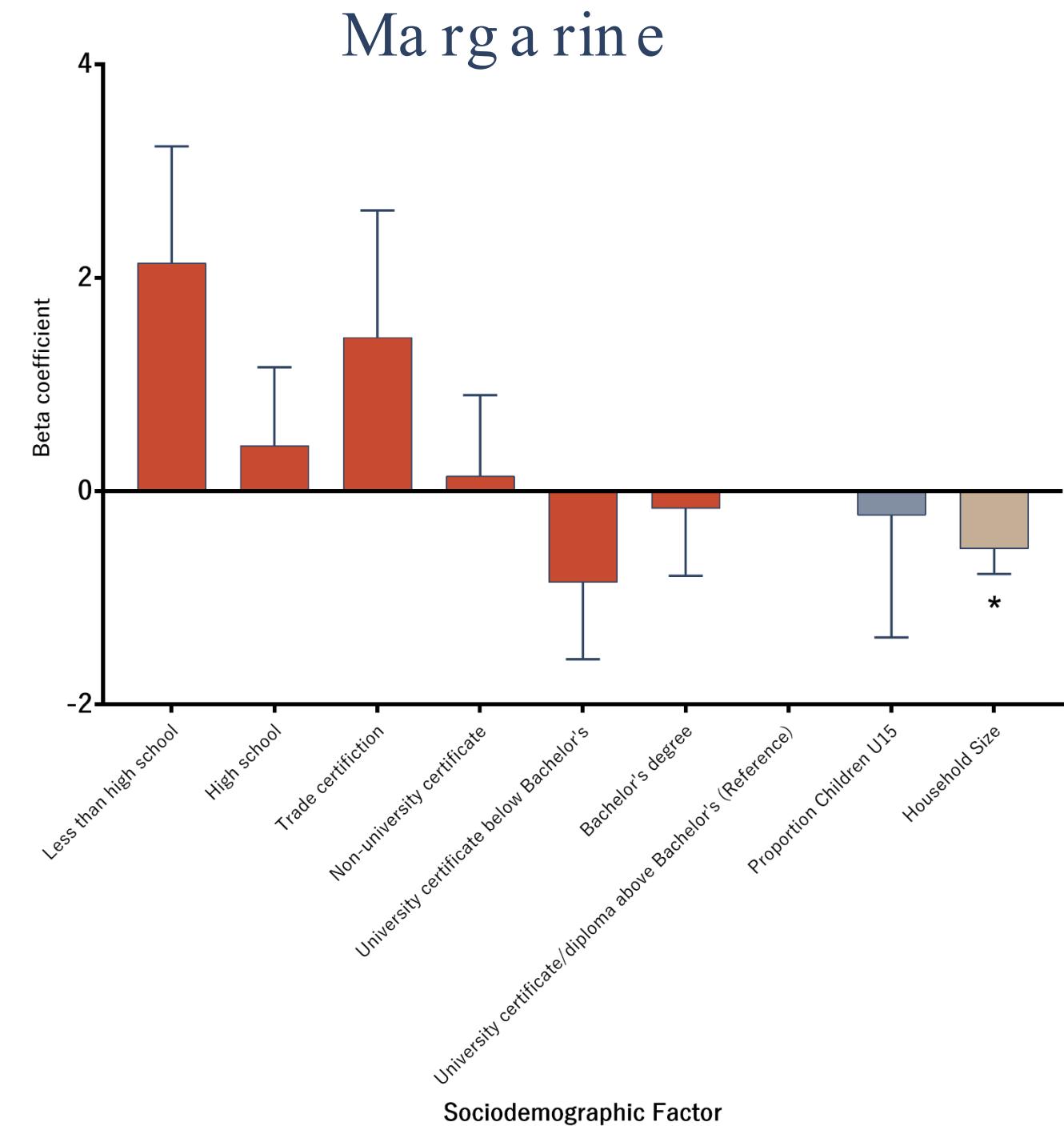
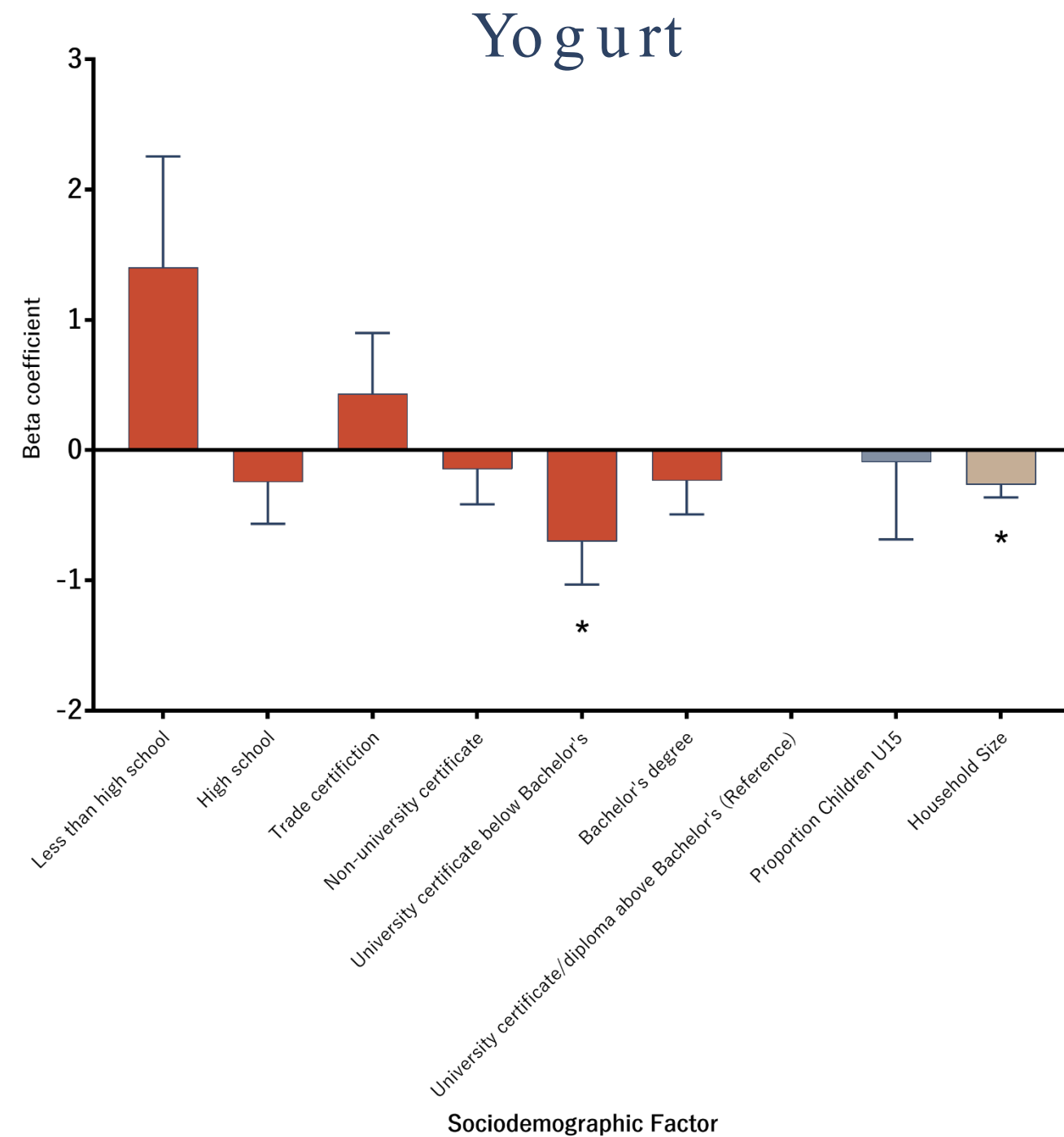
* Error bars denote standard deviations.

Impact of Income on Budgetary Share*



* Beta coefficients for linear regression models after adjustment for education, household composition and expenditure at restaurants. Error bars denote standard error. Asterisk represents significant differences in budgetary shares with household income ($p < 0.0001$).

Impact of Socioeconomic Status on Budgetary Share *



* Beta coefficients for linear regression models after adjustment for income and expenditure at restaurants. The highest education group was used as reference category. Error bars denote standard errors. Asterisk represents significant differences in budgetary shares with sociodemographic factor ($p < 0.05$).

Key Takeaways

Large percentage of households do not purchase Vitamin D fortified foods

Low-income households are less likely to purchase milk and yogurt

Households with lower education are less likely to purchase yogurt

Milk and yogurt purchases place a greater financial burden on low-income households

Policy Implications

Current fortification policies
disproportionally address households
of higher SES

Proposed fortification policies may not
resolve disparity

More accessible fortification vehicles
should be considered

Limitations

No data on ethnicity, supplements, kefir

Limited data on plant based beverages

Expenditure not quantity

Future Directions

Comparison with SHS 2021

High inflation
Increased cost of living
Altered purchasing behavior

Impact of Milk Alternatives

Relationship between
purchasing behavior and
education

Alternate Fortification Vehicles

Identify highly consumed
staple foods with equitable
distribution in population



Statistics
Canada

Statistique
Canada

McMaster
University



Dr. Anthea Christoforou

Christoforou Lab

- Auclair, O., Han, Y., & Burgos, S. A. (2019). Consumption of Milk and Alternatives and Their Contribution to Nutrient Intakes among Canadian Adults: Evidence from the 2015 Canadian Community Health Survey—Nutrition. *Nutrients*, *11*(8). <https://doi.org/10.3390/nu11081948>
- Cashman, K. D. (2020). Vitamin D Deficiency: Defining, Prevalence, Causes, and Strategies of Addressing. *Calcified Tissue International*, *106* (1), 14–29. <https://doi.org/10.1007/s00223-019-00559-4>
- Christakos, S., Li, S., De La Cruz, J., & Bikle, D. D. (2019). New developments in our understanding of vitamin D metabolism, action and treatment. *Metabolism*, *98*, 112–120. <https://doi.org/10.1016/j.metabol.2019.06.010>
- Government of Canada. (2022). *Marketing Authorization for Vitamin D in Milk, Goat's Milk and Margarine: SOR/2021 - 278*. <https://www.gazette.gc.ca/rp-pr/p2/2022/2022-01-19/html/sor-dors278-eng.html>
- Health Canada. (2023). *Notice of intent regarding the Minister of Health's intention to publish marketing authorizations to permit vitamin D fortification of yogurt and kefir and expand the eligibility for the dairy - related exemption from the front - of - package nutrition lab*. Government of Canada. <https://www.canada.ca/en/health-canada/services/food-nutrition/public-involvement-partnerships/notice-intent-marketing-authorizations-permit-vitamin-d-fortification-yogurt-kefir-expand-eligibility-dairy-related-exemption-front-of-package-nutrition-labelling-requirement.html>
- Mark, S., Lambert, M., O'Loughlin, J., & Gray-Donald, K. (2012). Household Income, Food Insecurity and Nutrition in Canadian Youth. *Canadian Journal of Public Health*, *103*(2), 94–99. <https://doi.org/10.1007/BF03404210>
- Statistics Canada. (2021). *Survey of Household Spending (SHS)*. Government of Canada. <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=1204699>
- Weiler, H. A., Sarafin, K., Martineau, C., Daoust, J. L., Esslinger, K., Greene-Finestone, L. S., Loukine, L., & Dorais, V. (2023). Vitamin D Status of People 3 to 79 Years of Age from the Canadian Health Measures Survey 2012-2019. *The Journal of Nutrition*, *153* (4), 1150–1161. <https://doi.org/10.1016/j.tjnut.2023.02.026>