

Dissecting vegetable expenditure patterns and exploring socioeconomic inequity pathways: Policy insights for traditional and modern contexts from a consumer choice model of loyalty retail data

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BACKGROUND

- Fruit and vegetable (FV) consumption remains consistently low despite numerous nutrition and policy interventions globally.
- Despite adaptation to local contexts, FV guidelines tie fruits and vegetables into one category, emphasizing fresh above other forms of processed FV.
- Psychosocial, cultural, economic, environmental, and accessibility factors can promote or inhibit consumption.
- Low FV consumption is tied to low socioeconomic status (SES).
- Different forms of FV along the processing continuum are associated with adverse nutrition profiles and long-term health outcomes.
- Availability and consumption of FV follows seasonal trends, with more pronounced effects on rural households.

CONTEXT & OBJECTIVES

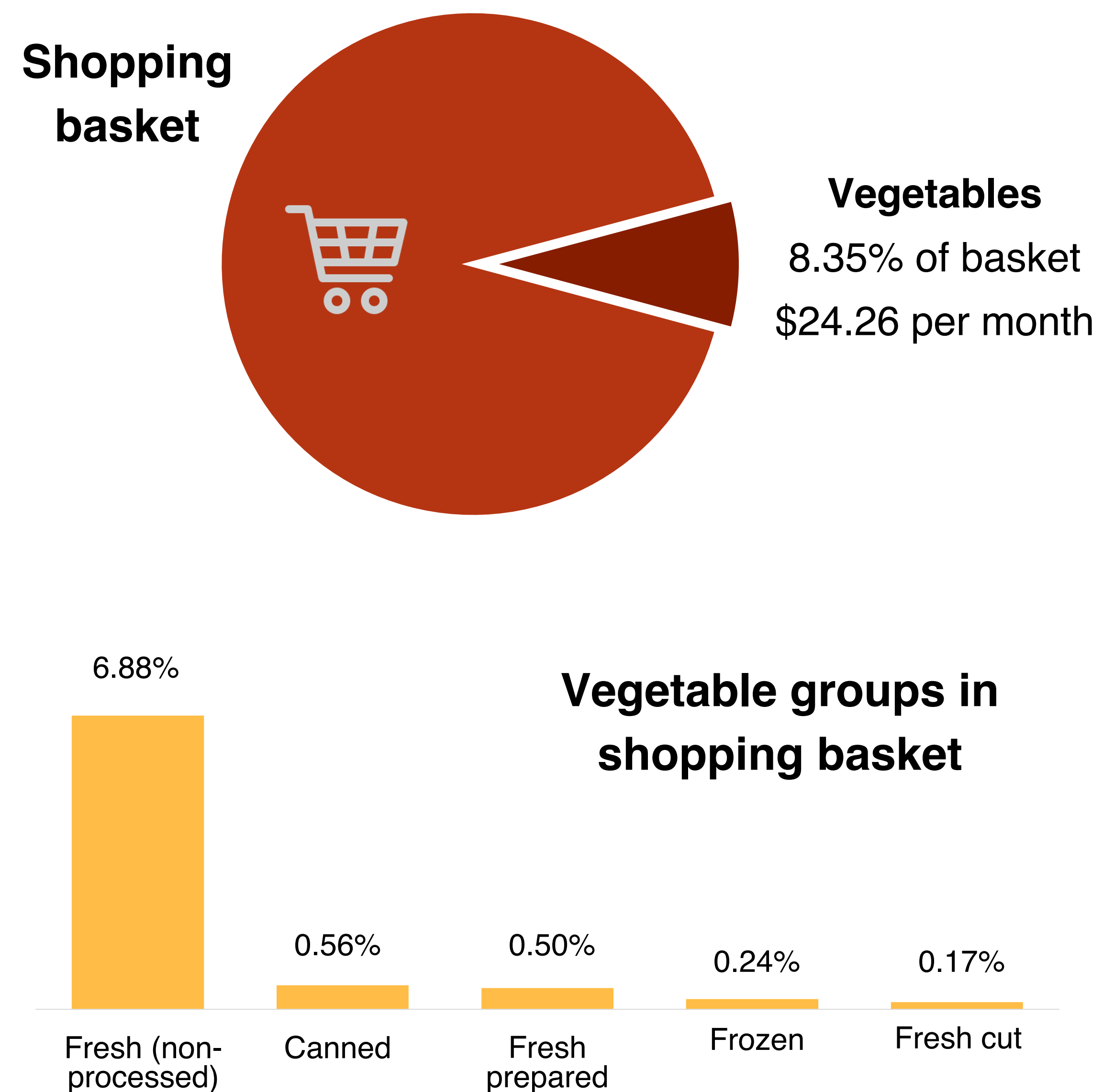
- Studies to-date have used inconsistent definitions for categorizing FV and relied on dietary questionnaires.
- Given the diversity of FV, compounded by the effects of marketing FV together in one category, a deeper investigation of drivers and consumption patterns is warranted for each.
- Our present studies segregates vegetables from fruits to objectively dissect expenditure patterns across processing levels.
- We contribute empirical evidence on the interplay between drivers of vegetable expenditure as a proxy for consumption, and explore the complex relationships by which SES acts.



STUDY DESIGN

- A leading Canadian grocery retailer provided retrospective consumer loyalty program data over 32 months from 2015-2017.
- All loyalty program member purchases are linked using a unique identifier, making the dataset representative of typical panel data.
- The 2016 census contributed socio-demographic indicators that were linked to postal codes for individual consumers.
- Approximately 300,000 shoppers, defined as those who shopped more than once per month during the study period, were included.

Fig 1. Avg expenditure share, by group



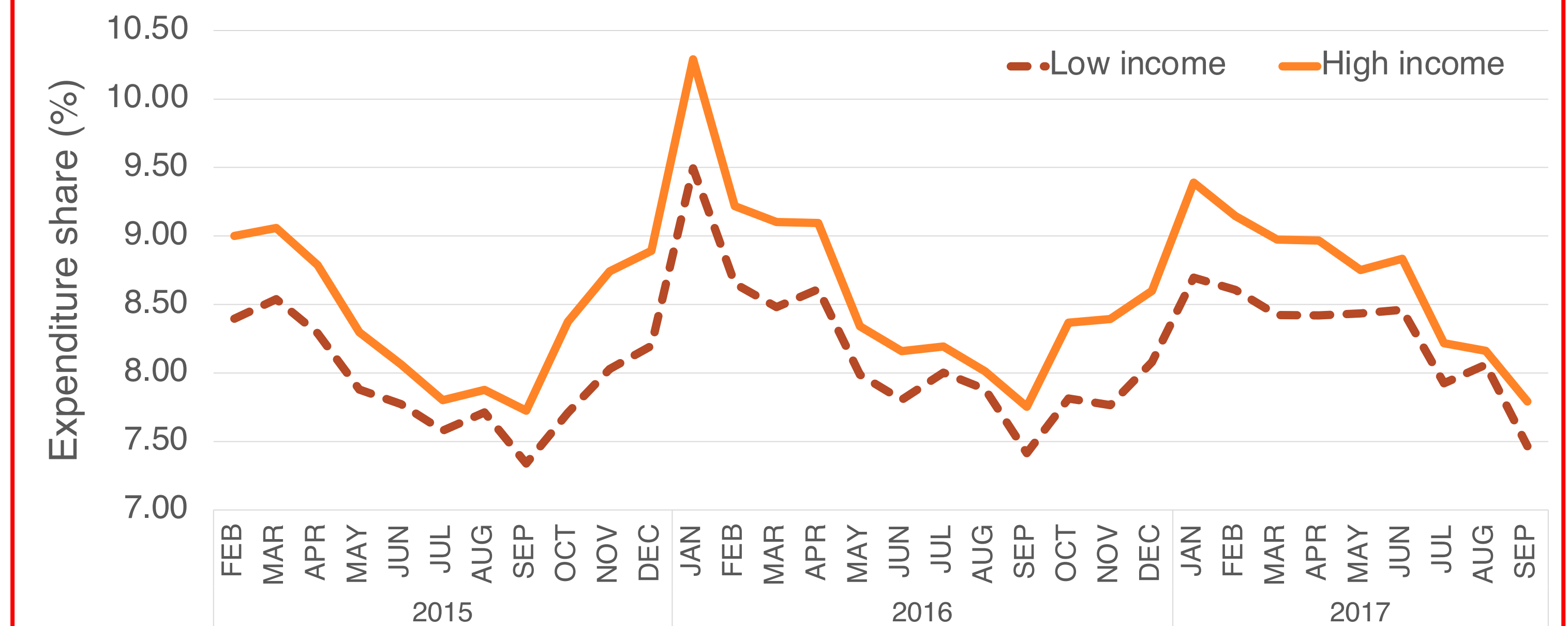
METHODS

- All vegetable stock keeping units (SKUs) were categorized into five groups by processing level: non-processed fresh, fresh cut, fresh prepared, canned, and frozen.
- Vegetable expenditure share of shopping baskets were constructed for consumer i and vegetable group g in month m as:

$$\text{Vegetable expenditure share}_{igm} = \frac{\text{vegetable expenditure}_{igm}}{\text{total food expenditure}_{im}}$$

- Panel random effect model was used to control for unobserved differences among individual households.
- Tobit modelling was used to deal with censored nature of the dependent variable.
- Positive β coefficients represent an increase in vegetable expenditure.
- In secondary analysis, consumer population was stratified by median split for low- and high- SES.

Fig 2. Avg veg expenditure share, stratified by SES



RESULTS

- Veg expenditure is highest in early winter and lowest in late summer; representing ~50% decrease from peak to valley.
- Low-income group exhibits less seasonal variation; spends less overall and on fresh, and more on canned or frozen ($p < 0.001$).
- Effect of family income was concentrated in high SES group.
- Consumers with higher post-secondary education in the low-income group spend more on vegetables ($\beta = 0.02$, $p < 0.001$).
- In-store variety was a positive driver of overall expenditure ($\beta = 1.07$, $p < 0.001$).
- High population density (i.e. urban) was most impactful negative driver of expenditure ($\beta = -16.81$, $p < 0.001$).

DISCUSSION

- SES factors can have a strong influence on vegetable purchases; findings of heterogeneous effects are new.
- Results point to a need for more specific vegetable consumption guidelines with provisions by processing level.
- Evidence supports ongoing investments in education as a core pathway to improving nutrition.
- Retail marketing practices (e.g. variety) can scale up impact.
- Governments play a catalytic role in fostering convergence across private and civil society to build a healthier environment.

ACKNOWLEDGEMENTS