# Food Shopping Profiles and Their Association with Dietary Patterns: A Latent Class Analysis

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**ABSTRACT**

**Background** Food shopping is a complex behavior that consists of multiple dimensions. Little research has explored multiple dimensions of food shopping or examined how it relates to dietary intake.

**Objective** To identify patterns (or classes) of food shopping across four domains (fresh food purchasing, conscientious food shopping, food shopping locations, and food/beverage purchasing on or near campus) and explore how these patterns relate to dietary intake among college students.

**Design** A cross-sectional online survey was administered.

**Participants/setting** Students attending a public 4-year university and a 2-year community college in the Twin Cities (Minnesota) metropolitan area (N=1,201) participated in this study.

**Main outcome measures** Fast-food and soda consumption as well as meeting fruit and vegetable, fiber, added sugar, calcium, dairy, and fat recommendations.

**Statistical analyses** Crude and adjusted latent class models and adjusted logistic regression models were fit.

**Results** An eight-class solution was identified: "traditional shopper" (14.9%), "fresh food and supermarket shopper" (14.1%), "convenience shopper" (18.8%), "conscientious convenience shopper" (13.8%), "conscientious, fresh food, convenience shopper" (11.8%), "conscientious fresh food shopper" (6.6%), "conscientious nonshopper" (10.2%), and "nonshopper" (9.8%). "Fresh food and supermarket shoppers" and "conscientious fresh food shoppers" had better dietary intake (for fast food, calcium, dairy, and added sugar), whereas "convenience shoppers" and "conscientious convenience shoppers," and "nonshoppers" had worse dietary intake (for soda, calcium, dairy, fiber, and fat) than "traditional shoppers."

**Conclusions** These findings highlight unique patterns in food shopping and associated dietary patterns that could inform tailoring of nutrition interventions for college students. Additional research is needed to understand modifiable contextual influences of healthy food shopping.

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FOOD SHOPPING IS A COMPLEX BEHAVIOR THAT CAN be characterized by various dimensions (eg, location, frequency, and quantity). Research on food shopping is limited and has focused primarily on socioeconomic position. For example, people in low socioeconomic position are more likely than those in high socioeconomic position to buy carry-out food and sugar-sweetened beverages[1] and have more limited access to stores selling healthy foods.[2-4] In addition to this limited scope of work, another limitation of existing studies is that typically only one aspect of food shopping has been assessed. One study examining multiple food-related behaviors found that planning meals before food shopping was associated with greater fruit/vegetable consumption among women.[5] However, planning meals was assessed independently of other food shopping factors, and this approach may not capture the complex patterning of shopping behavior that may be important to understand in developing effective intervention strategies.[6]

In addition to these behavioral complexities, shopping behaviors are likely to be distinctive depending on stage of life and life circumstances. For example, research has shown that dietary quality is often exceedingly low while attending college.[7-12] With 20.6 million students enrolled in postsecondary institutions in the United States,[13] the college setting may be an important venue for targeting and addressing wellness-related behaviors among a large population of adult students. Despite this, little research has focused on developing healthy eating-related interventions for the college setting.[14]

The objectives of the analysis were to identify food shopping patterns and assess the relationship between food shopping and types of foods and nutrients consumed among a diverse sample of college students. We hypothesized that more favorable patterns of shopping, such as purchasing more fresh foods and fewer convenience foods, would be associated with healthier dietary intake.

## METHODS

The Student Health and Wellness Survey assessed weight-related factors among college students in the Twin Cities area of Minnesota. Students from two institutions (a 2-year community college and 4-year university) were approached by study staff in high-traffic campus areas and invited to complete an online survey. Enrolled students aged ≥18 years were eligible to participate and provided consent online before data collection. For four study participants, their age based on the birthdate reported on their completed survey was 17 years. The University of Minnesota Institutional Review Board provided the researchers with authorization to maintain these age-ineligible participants' survey data in the dataset. The final sample was 1,201 students (2-year n=598 and 4-year n=603). Additional details on the study have been described previously.[12,15] Study protocols were approved by the University of Minnesota Institutional Review Board.

### Independent Variables: Shopping Measures

Fourteen food shopping behaviors from four domains were assessed: fresh fruit and vegetable purchasing, conscientious shopping (ie, buying foods from organic, local, or sustainable sources), type of shopping locations, and food/beverage purchasing on or near campus. Based on previous research, these domains were identified as the most salient for healthy eating among a college population.[10,11,16] Conscientious shopping has been associated with healthier diets,[11] whereas on or near campus shopping has been associated with less-healthy diets among college students.[10] In addition, access to supermarkets compared with convenience stores tends to be associated with healthier diets.[16] For many of the food shopping items, test–retest and/or construct validity have been established in previous research.[11,17-20]

Purchasing fruits and vegetables was assessed using a question adapted from previous research[19,20]: "During the past 30 days, about how often have you: (a) Purchased a fresh vegetable(s)? (b) Purchased a fresh fruit(s)?" Response options ranged from never to ≥3 times/day and were dichotomized at ≥1/wk. Participants provided separate responses for vegetables and fruit.

Conscientious food shopping was assessed using a five-part question to determine the frequency of purchasing items that were organically grown, made with organic ingredients, not processed, locally grown, or grown using sustainable agricultural practices. Responses were dichotomized into "Never/rarely," and "Sometimes/often."[11] This question was adapted from Project Eating Among Teens, a large study of adolescents and young adults.[17]

Type of purchasing location was assessed by asking: "During the past 30 days, about how often have you purchased food from…" Locations included: "(a) A supermarket, such as [local examples provided]," (b) "A convenience store (including any corner stores or food stores that are smaller than a supermarket)," (c) "Any stores like Target, Super Target, Costco, or Sam's Club," and (d) "A food co-operative (co-op) such as [local examples provided]." Response options ranged from never to ≥3 times/day.

Finally, food and beverage purchasing patterns on or near campus were assessed by asking: "During a normal week, how many days per week do you: (a) Buy food from a vending machine on campus? (b) Buy a beverage on campus? (c) Buy food or a beverage from a restaurant or store within walking distance of campus?"[18] Response options ranged from 0 to 7 days.

To facilitate interpretability, food shopping variables were recoded into dichotomous indicators (using cutoffs of ≥1/wk for purchasing fresh fruit and vegetables, food shopping locations, and on or near campus shopping and "sometimes/often" for food shopping from alternative production practices). Cutoffs were determined based on a reasonable distribution and alignment with expected shopping needs (eg, frequent shopping of fresh foods that is needed to maintain a consistent supply).

### Outcome Variables: Food Consumption

Fast food, sweetened carbonated beverages, fruit and vegetable, calcium, dairy, fiber, added sugar, and fat consumption were assessed. These aspects of food consumption are highlighted in the Dietary Guidelines for Americans[21] and are key dietary challenges for many college students.[22] Fast food was assessed as frequency of eating food from establishments where food is ordered at a counter or drive-through window during the past 30 days.[23] Sweetened carbonated beverage consumption was assessed by asking: "During the past month, how often did you have regular, carbonated soda, pop, or soft drinks that contain sugar? (Do not include diet soda.)" Response options ranged from never to ≥5 times/day.[23] Fruit and vegetable consumption (in cups) was calculated from past month reported consumption of fruit juice, fruit, salad, french fries, potatoes, vegetables, tomato sauce, and salsa by taking the midpoint of each response option and summing across different items, consistent with previous research.[24-26] Calcium, dairy, fiber, and added sugar, were assessed as part of the National Cancer Institute Five-Factor Screener,[24] whereas fat was assessed using a modified Percentage Energy from Fat Screener.[15,24]

With the exception of fast food and sweetened carbonated beverages, all dietary variables were dichotomized based on meeting national recommendations for health.[27-32] Personalized recommendations, based on participant age, sex, and physical activity level (for fruits and vegetables and added sugar only), were calculated for fruits and vegetables, added sugar, and calcium, aligning with national recommendations.[27-30] For fiber, individuals met recommendations if they consumed between 21 and 38 g/day based on age and sex; for dairy, meeting recommendations were those who consumed ≥3 servings/day; and for fat, if participants consumed <35% of calories from fat they met recommendations. Additional details on these consumption variables have been previously published,[12,15] including validity results.[23,25,26,33] For fast-food and sweetened carbonated beverage consumption, dichotomization cutpoints were consistent with previous studies: ≤1/wk (fast food) and ≤1/day (sweetened carbonated beverages).[8]

### Covariates

Covariates included sex, race/ethnicity, employment, parent's education, relationship status, having children, living situation, self-perception of being an adult, and being on a college meal plan.[7,9,12,19] Race/ethnicity categories included "non-Hispanic white," "black," "Asian or other Pacific Islander," and "Other race(s) and Hispanic." Employment categories ranged from 0 to ≥30 hours. Relationship status was categorized as single vs nonsingle (which included "In a committed