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Research Article

Food access, purchasing habits and dietary diversity of peri-urban households in Hanoi, Vietnam

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Highlights/Key Messages

- Frequent buyers had lower incomes but higher dietary diversity.
- Processed food groups, like oils, fats and sweets, not fresh produce, drove the increase in higher HDDS.
- Time scarcity and supermarket growth will continue to reshape urban food habits.

Background
Urban and peri-urban areas increasingly concentrate food insecurity, making food access a key urban equity issue. In rapidly urbanising Asian cities, formal and informal food vendors coexist, so households can choose among food sources with different characteristics. Yet studies often analyse food access using income or residential location alone, overlooking the role of everyday purchasing behaviours.

Objective
This study examines how food purchasing patterns and vendor choice relate to dietary diversity among peri-urban households in Hanoi.

Methods
We use cross-sectional survey data, collected from 157 households in 11 geographically and socioeconomically diverse wards in a peri-urban area of Hanoi. Using k-means clustering, we group households by food-purchasing frequency and their reasons for choosing specific vendors. We compare clusters ("frequent buyers" and "low-frequency buyers") across socioeconomic characteristics, food expenditure, transport modes, spatial access to vendors, urban agricultural activity, and their household dietary diversity score (HDDS).

Results
Low-frequency buyers had higher mean income per capita, while frequent-buyers had a slightly higher mean HDDS. This difference was driven primarily by greater consumption of processed food groups (oils, fats and sweets) rather than increased intake of fresh or nutrient-dense foods. Both groups prioritised proximity, affordability, and product assortment when choosing where to shop. Although proximity was the primary consideration, we found no significant differences in distance-based access to food vendors, though transport modes differed between clusters.

Conclusions
Our results show how purchasing habits mediate between upstream drivers and dietary diversity. The association between frequent purchasing and higher processed food consumption may reflect time constraints, which lead households to favour convenience items, even when shopping at traditional markets. The ongoing expansion of supermarkets could further accelerate this trend of increased processed food consumption. Behaviour-based segmentation complements income- or location-based approaches for studying urban food policy, nutrition and food accessibility in rapidly growing cities by recognising the important role of traditional food sources.

Keywords: food environment, new urban area, Asia, urbanisation, urban farming, food access, food consumption

Introduction

The Committee on World Food Security (FAO, 2024) reports that over 75% of people experiencing food insecurity live in urban and peri-urban areas, highlighting the urgency of addressing food access as an urban equity issue. While global progress has been made in reducing food insecurity, equitable access to diverse and nutritious food remains a persistent challenge in rapidly urbanising regions, particularly in low- and middle-income countries (LMICs). This urbanisation process, happening most rapidly in Africa and Asia, often unfolds amid limited institutional capacity and weak urban planning, leading to the expansion of unplanned urban areas and a growing concentration of urban poverty (Tacoli, 2017; Chant & McIlwaine, 2016). This has implications for food systems and social inequality, creating new challenges for food security (The Anh & Cong, 2020; Crush & Frayne, 2011; Tacoli, 2017; N. Nguyen et al., 2021; Wertheim-Heck et al., 2019).

Urban food environments are widely recognised as important determinants of dietary outcomes. In rapidly urbanising Asian contexts, these environments are changing substantially, increasing the need to better understand how people access food (Atomei, 2017; Nguyen et al., 2021; Wertheim-Heck et al., 2019). The food environment comprises physical, economic, and sociocultural characteristics, as well as the policies, conditions and agency that influence consumer behaviours and their nutritional status (Turner et al., 2025). A healthy food environment would be one where nutritious food is available and affordable to everyone (Swinburn et al., 2013). While food environments influence food security outcomes, food security is a much broader concept encompassing four interrelated pillars: availability, access, utilisation, and stability (FAO, 2024). Among these, the food access dimension of food security refers not only to the economic and social capacity to purchase or otherwise obtain food, but also to the physical proximity to food sources within the food environment.

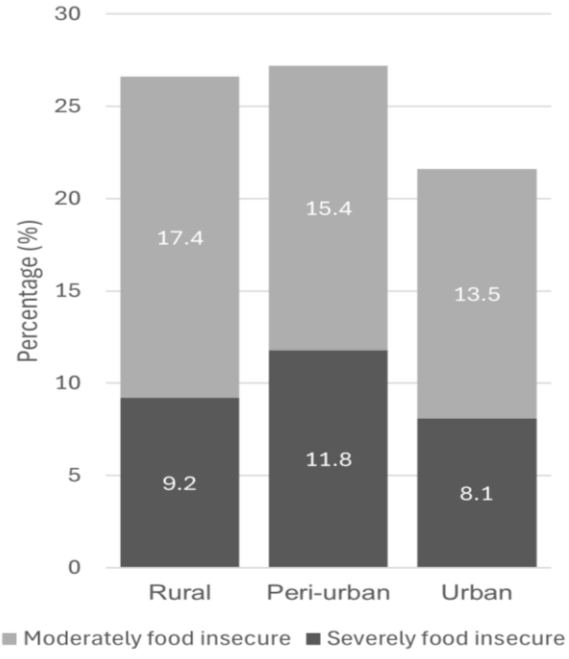

Figure 1. Prevalence of food insecurity along the rural-urban gradient in Asia (Adapted from FAO, 2024)

In (peri-)urban settings, this physical pillar of food access is particularly critical. Urban households are largely dependent on food markets rather than self-production, and their food choices are therefore shaped by physical proximity, accessibility to food sources, shifts in food provision due to external factors (such as environmental disasters, geopolitical conflicts, technology and markets shifts), as well as personal and cultural preferences and beliefs (Crush & Frayne, 2011; FAO et al., 2024; Nguyen et al., 2021; Popkin & Ng, 2022; Proctor & Berdegué, 2016; Satterthwaite et al., 2010; Tacoli, 2017; Wertheim-Heck & Raneri, 2020; Wertheim-Heck & Raneri, 2019). Food access also includes the diversity of food options households can access in practice, within their time and mobility constraints (FAO, 2024; Wertheim-Heck et al., 2015).

As a result, food access in cities cannot be understood solely through income-based measures, but must also account for how spatial, temporal, behavioural factors shape everyday food acquisition patterns within the food environment (Hemerijckx et al., 2022; Wertheim-Heck et al., 2015). This paper primarily follows Turner et al.'s (2018, 2025) food environment framework, in which accessibility refers to spatial proximity to food, while affordability, desirability, and convenience are treated as separate personal dimensions. To avoid confusion with the food access dimensions of food security, which refer to the economic and social capacity to obtain food, as well as the physical proximity and accessibility to food sources, we will further specify the kind of access (economic, social or spatial) mentioned throughout this paper.

Rapid urbanisation is contributing to growing food insecurity challenges in urban areas of LMICs (FAO et al., 2024). While rural populations remain the most food-insecure in most regions, Asia has the highest rates of food insecurity in peri-urban areas, with over 27% of the peri-urban population moderately or severely food insecure (Figure 1, FAO et al., 2024). In addition, rapid urbanisation in Asia has been associated with an increase in non-communicable diseases (NCDs), poverty, and the double burden of malnutrition (Talukder et al., 2026; Nguyen et al., 2025; Wertheim-Heck et al., 2019), i.e. the simultaneous presence in a population of overweight and undernutrition. In Vietnam, rising overweight and obesity rates have been observed in parallel with increased consumption of ultra-processed food (UPF) (Béné et al., 2026; Nguyen et al., 2025) a trend that is observed globally (Popkin & Ng, 2022) as well as in other Southeast Asian countries (Talukder et al., 2026; Zanello et al., 2026). Incorporating food planning into urban development strategies can therefore support more sustainable food systems and advance spatial justice in rapidly urbanising areas (Hemerijckx et al., 2023; Pulliat, 2015).

Urban Vietnam shows how rapid urbanisation can go hand in hand with rapid transformation of the food environment. Vietnam is undergoing rapid urbanisation: in 2024, the urban population reached 38.7 million people, representing 38.2% of the total population, with projections to reach 50% by 2045 and 65% in 2074 (NSO & UNFPA, 2025). It has emerged as one of Southeast Asia's most dynamic economies, reflecting consistent economic growth and poverty reduction over the past decade (World Bank, 2025).

While poverty has declined, income disparities persist, particularly between rural and urban areas (Anh, 2024), and food insecurity and food safety remain a challenge (Sethi et al., 2020; Wertheim-Heck & Raneri, 2020).

The Vietnamese urban retail food environment is characterised by the coexistence of modern and traditional informal and formal food outlets such as wet markets, supermarkets, street vendors, convenience stores, speciality stores, and food trucks (Atomei, 2017; Barthelmes, 2015; Huynh, 2023; Nguyen et al., 2021; Truong, 2018; Wertheim-Heck et al., 2019). However, urban food policies have failed to recognise informal and traditional food sources as important components of urban food provisioning. The "supermarketisation" phenomenon, as described by Reardon et al. (2005), involves the spread of modern food outlets in the Pacific Rim Region, transforming the traditional food environment. In Vietnam, this supermarketisation is promoted on the grounds of food safety concerns regarding informal food vending (Atomei, 2017; Even et al., 2025b; Hansen, 2022). However, without prioritising the affordability of healthy food options, these risks make unhealthy products more affordable for lower-income households and may exclude the needs of vulnerable groups within the Vietnamese population (Even et al., 2025a; Hansen, 2022). There is a lack of policy efforts to incentivise the promotion of healthy food items while minimising ultra-processed food, as the current focus remains oriented towards food safety, expanding modern retailers, and displacing traditional markets without ensuring that nutritious food is physically and economically accessible to everyone (Even et al., 2025b; Even et al., 2023).

This displacement of traditional food outlets does not align with the needs of lower-income households in Hanoi, as 70% of their food purchases come from these sources (Wertheim-Heck et al., 2019). Therefore, the informal and traditional markets continue to play a central role in daily food provisioning, especially for fresh products, due to their affordability, proximity, and sociocultural embeddedness (Barthelmes, 2015; Even et al., 2025a; Harris et al., 2020; Huynh, 2023; Nguyen et al., 2021; Wertheim-Heck et al., 2019). While often tied to informal economic activities and perceived as a sign of poverty, these vendors also provide employment, strengthen social cohesion, and support culturally appropriate diets (Atomei, 2017; Steyn et al., 2014; Truong, 2018; Wertheim-Heck & Raneri, 2020).

The supermarketisation of the urban food environment can also negatively affect diet and nutrition (Atomei, 2017), as it may decrease consumption of fresh products and increase consumption of ultra-processed foods (Hawkes et al., 2017). Studies across Southeast Asia indicate that more frequent use of modern retail outlets may have negative dietary health implications (Gaupholm et al., 2022; Rupa et al., 2019; Toiba et al., 2015; Kelly et al., 2014). Households that rely more often on modern retailers tend to alter their dietary composition, purchasing relatively more ultra-processed foods compared with the mainly fresh and unprocessed foods obtained from traditional markets (Wertheim-Heck et al., 2019). This approach to promoting food safety assumes that food consumption behaviour results from rational choice, overlooking different lifestyles, cultural and personal preferences, and changes in dietary composition (HLPE, 2017; Muñoz & Marselis, 2016). Harris et al. (2020) note that much of the literature on the nutrition transition has focused on macro-level drivers, such as income growth and demographic change, leaving a persistent "missing middle" connecting these upstream drivers to actual dietary outcomes.

In Vietnam, proximity to supermarkets does not necessarily increase use or dietary quality (Wertheim-Heck & Raneri, 2020). Those responsible for household food acquisition, predominantly women, tend to prefer wet markets because of perceived product freshness, time, and trust built through social interactions with vendors (Figuié et al., 2019; Raneri et al., 2019). Agency within a society's social and physical structures shapes food purchasing and consumption (Hansen, 2022), which are part of the food environment. Even when conditions narrow options, people still choose food based on their beliefs and preferences. This helps explain why drivers, like economic growth, do not automatically improve dietary quality, as sociocultural contexts and household and individual practices mediate these effects. In Vietnam, despite rapid economic growth, declining poverty rates, and improvements in education and health, evidence linking upstream food system factors to downstream diet and nutrition outcomes remains limited (Harris et al., 2020). This gap underscores the need to examine household food acquisition habits and strategies as mediators of dietary diversity in rapidly growing urban contexts (Gaupholm et al., 2022; Hemerijckx et al., 2022). Without understanding food-purchasing frequencies and motivations, policies risk mismatching the everyday realities of urban food access.

This study examined whether households with distinct purchasing habits differ in their consumption patterns. We test whether households with different purchasing habits, defined through the frequencies and reasons for purchasing from various food outlets within the food environment, demonstrate significantly different dietary diversity scores, which food groups drive any observed differences and whether, despite differences in purchase frequency, households prioritise similar vendor attributes. This paper provides descriptive evidence on the "missing middle" (Harris et al., 2020) between upstream drivers and dietary outcomes, demonstrating whether and how household food purchasing habits differ in their association with dietary diversity, while also describing how income and proximity relate to different household profiles in peri-urban Hanoi.

Methods

Study area: Long Biên, Vietnam

The present research focused on a new urban area on the east bank of the Red River, located within the capital city of Hanoi (Figure 2). The study area comprised 11 wards across two districts: nine wards in Long Biên District and two neighbouring wards from Gia Lâm District (Đông Dư and Cổ Bi). The study area was selected because of its rapid urban

transformation following major infrastructure investments, particularly the construction of the Vĩnh Tuy and Thanh Trì Bridges in 2009. The bridges significantly improved connectivity between central Hanoi and peripheral districts, leading to rapid urban expansion into the study area (Figure 2). These developments stimulated private investment, including projects such as AEON Mall, Hanoi's first Japanese shopping complex, and Vinhomes Riverside, a large-scale residential development. Together, these investments exemplified the district's transition towards a more modernised urban environment, shaped by state-led "modernisation" and private-sector development. Since their rapid development, Decree 132/2003/ND-CP (Government of Vietnam, 2003) classifies the Long Biên and Gia Lâm districts as urban, though they are not (yet) considered part of Hanoi's city centre. We acknowledge that the rural-urban gradient is not a dichotomy (Van Vliet et al., 2020) and will refer to the study site as a new (peri-)urban area throughout this article.

The coexistence of modern retail investments and enduring traditional food vendors made the new urban area in Long Biên and Ga Lâm a particularly relevant setting for examining how households' purchasing patterns related to dietary diversity within a rapidly transforming food environment. The study area captured the transitional conditions of rapidly urbanising Southeast Asian cities, where policy-driven modernisation of the food environment proceeded alongside deeply embedded traditional food vendors (Atomei, 2017; Even et al., 2025b; Hansen, 2022; Wertheim-Heck & Raneri, 2020). Studying households' food purchasing patterns and consumption behaviours in this context allowed the analysis to identify behavioural and dietary differences within a heterogenous food environment.

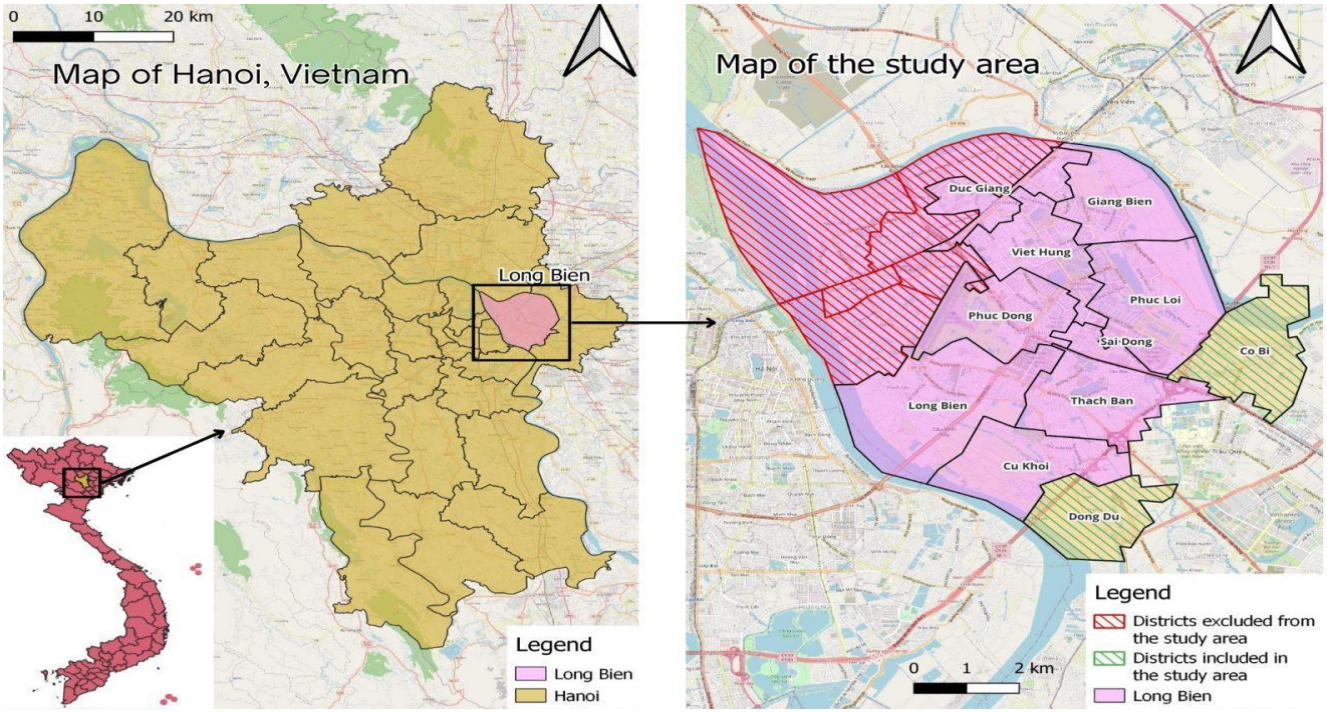

Figure 2. Geographic position of the study area (A) within Vietnam and (B) within Hanoi city. (C) Map displaying the wards included within the study area (Boundaries: OpenStreetMap).



Figure 3. Urbanisation in Long Bien. Left shows an aerial image of Long Bien from December 1999, middle shows an image from December 2007, just before the opening of the Vinh Tuy and Thanh Trì bridges in 2008/2009, right an image from December 2020 (Data LandSat/Copernicus, retrieved via Google Earth Pro).

Conceptual Framework

Turner et al.'s (2018, 2025) framework of food environments in LMICs, comprises external domains (food availability, prices, vendor and product properties, marketing, and regulation) and personal domains (spatial accessibility, affordability, desirability, and convenience). Consumer behaviour is shaped by these food environment domains (HLPE, 2017), and in this paper, it is defined through household food purchasing habits, which in turn shape consumption patterns and dietary outcomes (FAO, 2022). We also incorporated agency (Giddens, 1979) as an overarching concept linked to social and economic food access, as well as time and personal mobility constraints, determining both opportunities or limitations for consumer behaviour within the food environment (HLPE, 2020; Turner et al., 2025). Following Hansen (2022), we understand this agency as the capacity of households to negotiate food choices within structural constraints imposed by the food environment.

We identified household purchasing habits based on two empirical axes: i) the frequency of purchase from different food vendors, and ii) the reasons households report for choosing those vendors. Food consumption patterns were captured through dietary diversity, measured using the Households Dietary Diversity Score (HDDS), which served as the dependent variable, as a proxy for economic access to food (FAO et al., 2024). We analysed socioeconomic characteristics, food expenditure, transport use, and spatial access to vendors as descriptive variables.

Data Collection

A team of 9 enumerators and 3 supervisors based at Vietnam National University (VNU) in Hanoi and KU Leuven in Belgium collected a primary survey dataset over six weeks, from September to November 2024. The study used a combination of snowball and random sampling methods to collect 200 geolocated surveys from households across the socio-economic spectrum, plus as many food outlets as possible in geographically distributed locations across the study area. The sampling deliberately included households located in older and newer urbanised, and more affluent wards such as Vinhomes Riverside, providing a sample across the socioeconomic and spatial diversity of Long Biên. Food vendors were deliberately sampled near households to capture the outlets most frequently visited by household respondents and to facilitate proximity-based analyses. We approached 212 households and 283 food vendors; 164 and 235, respectively, provided informed consent for the survey. According to Cochran's sample size formula, this sample size resulted in error margins of 4.1% and 3.4%, respectively. After a missing-data analysis of food purchasing frequency and motivations for purchasing from different food vendors (i.e., retaining only households that answered these questions in the survey), 157 households were included in the analysis (seven households were excluded). Food trucks (n = 23) were excluded from the analysis because only three households reported them, compared with 26 households for the second least-frequented vendor type (wholesalers). This suggests respondents may have misinterpreted the food truck category. The final sample contained food vendors and households from all 11 wards, and the two clusters identified in the analysis were distributed across all wards. We administered the surveys in Vietnamese using KoboToolbox (version 2024.2.4) via smartphones and tablets. The survey protocol which was developed in the framework of a larger comparative study with cities in Africa and Latin-America, was approved on July 10th 2024 (approval number G-2024-8138-R2) by the KU Leuven Social and Societal Ethics Committee (SMEC). The household survey instrument used for this study is provided in Appendix 2. For food vendors, we only noted their type and GPS location. Figure 4 provides an overview of the data collection process.

The household survey explored spatial, economic and social food access, as well as socioeconomic characteristics and food consumption practices and was designed to last approximately 30 minutes. The first section collected sociodemographic information, including household size and owned assets. The second section focused on food-related practices, covering food consumption, food acquisition, production (urban agriculture), and sharing. Respondents reported the types of food vendors they frequented, visit frequency, reasons for choosing each vendor type, modes of transport used, travel time, and vendor location. To measure spatial proximity, respondents reported travel time in minutes from their home to each vendor type visited. Household and vendor locations were georeferenced during the surveys, enabling calculation of network distances using QGIS (version 3.28.11), which were then compared across household clusters and with self-reported travel time.

As the questionnaire was administered in the framework of a larger comparative study, eight broad categories of food vendors were identified: (i) large supermarkets, (ii) small grocery and convenience stores, (iii) fresh markets, (iv) street vendors, (v) wholesalers, (vi) speciality food shops, (vii) restaurants, and (viii) food trucks. This reflects the approach by Nguyen et al. (2021), and merges the categories of "convenience stores" into small grocery and convenience stores; "informal markets", as street vendors or food trucks depending on their description; "wet markets" as fresh markets; "specialised" shops as speciality food shops; and "restaurants", "local beer corners" and "cafes" as restaurants. For small grocery and convenience stores and wholesalers, since Nguyen et al. (2021) do not specify these categories, Table 1 provides a detailed description, as they were also present in the food environment in Long Biên. Figures 5 and 6 show the spatial distribution of households per cluster and the different types of food vendors.

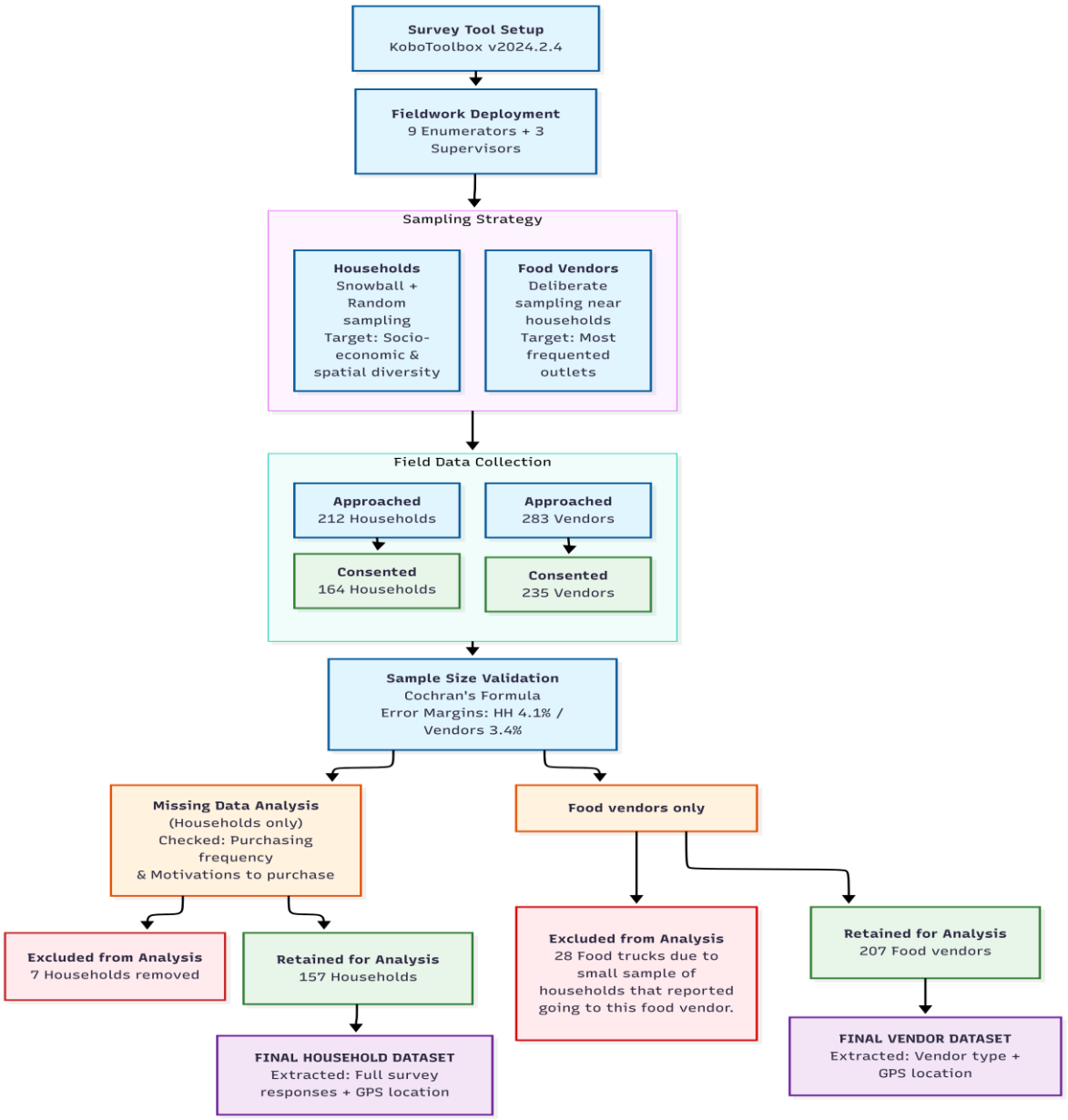

Figure 4. Flowchart of the data collection process

Table 1. Categories of food vendors and their descriptions

Food vendor type	Description
Large supermarket	Chain supermarkets that offer a vast variety of processed, ultra-processed, and whole food products.
Small grocery and convenience stores	Small format store that can be a franchise, non-chain grocery store, or mom-and-pop store, and offers food and non-food items, including processed, ultra-processed, and whole products.
Fresh market	Traditional local and fresh markets in Vietnam, selling a wide variety of whole foods like meat, fish, but mainly fruits and vegetables. Vendors with a fixed position are considered in this category. Fresh markets can be established by authorities or be informal, and have a large number and wide variety of vendors.
Street vendor	Mobile vendors that are located on the street and sell whole foods, mainly fruits and vegetables. They are usually informal and can be found next to fresh markets, but they do not have a fixed position there.
Wholesaler	Businesses in permanent building structures that sell goods in large quantities, mostly to retailers or other commercial entities.
Speciality food shops	Specialisation stores that sell goods in a particular food category, such as bakeries, butcher shops, fish shops, tofu shops, etc.
Restaurant	Dine-in locations selling whole, (minimally-)processed and ultra-processed food where people pay to sit and eat. They can provide table service and usually have a menu with different food and drink options.

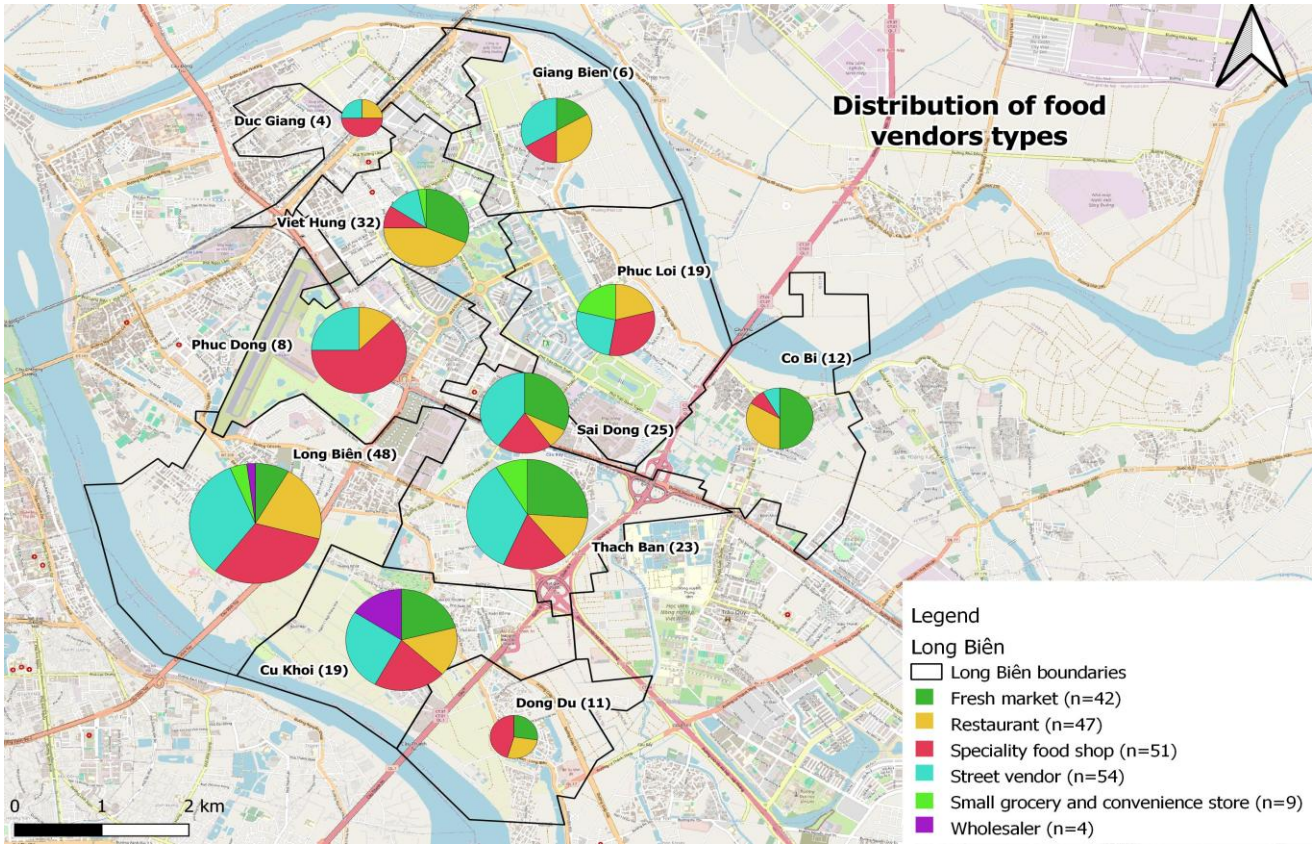

Figure 5. Spatial distribution of surveyed food vendors. The number in parentheses indicates the count of surveyed food vendors in each ward. Please note that no large supermarkets were surveyed

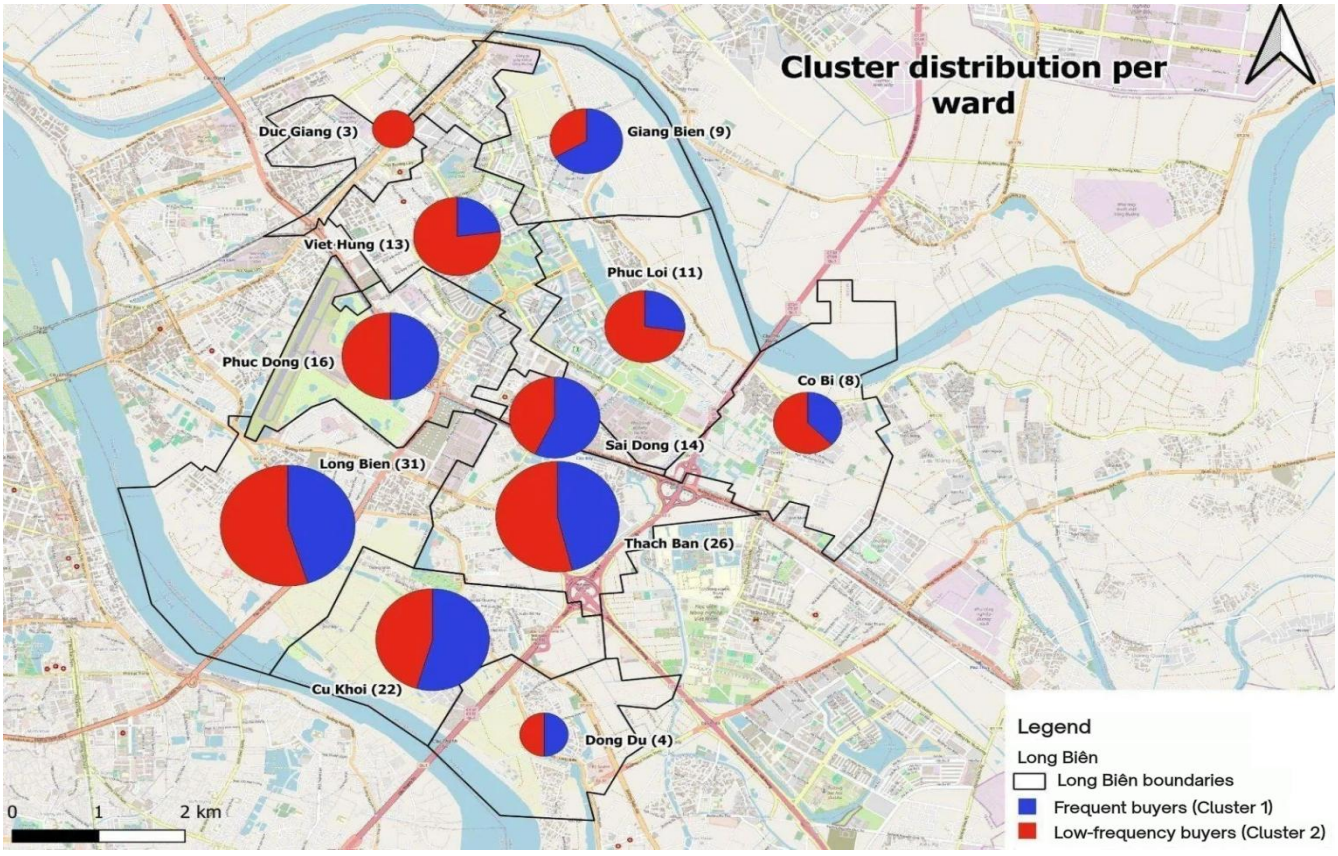

Figure 6. Spatial distribution of surveyed households divided by cluster. The number in parentheses indicates the count of surveyed households in each ward.

Cluster-based Analysis

To identify distinct household food-purchasing patterns, we conducted a K-means cluster analysis in R (version 4.4.0) using the base stats package. Two clusters were constructed using two sets of variables: (i) the frequency of food purchases from each type of food vendor (monthly frequency score ranging from 0 to 40), and (ii) the reported reasons for purchasing food from those vendors, including assortment, proximity, quality, healthiness, trust, affordability, or other. We determined the number of clusters by comparing solutions with k = 2 and k = 3. We selected the two-cluster solution (k=2) because it produced groups with clearly distinct purchasing frequencies and was the most interpretable in terms of food acquisition behaviour. For each of the eight vendor types, households could select one or more reasons, for a total of 56 binary indicator variables capturing motivations across all food vendors.

All variables were standardised to z-scores prior to clustering to prevent variables with larger numeric ranges from dominating the analysis. We ran the final k-means algorithm with 25 random starts. Comparative analyses assessed differences between clusters in socioeconomic characteristics and food consumption patterns. These included monthly household income, monthly food expenditure, education level, HDDS, differences in the means of transport used to access each type of food vendor, and consumption of specific food products based on the HDDS food groups. For continuous variables, we used t-tests; for categorical variables, we used chi-square tests. All statistical analyses were performed in R (version 4.4.0), and spatial analyses of vendor access and household locations were conducted in QGIS (version 3.28.11).

Results

Food Acquisition Patterns

To assess whether consumption patterns differed across purchasing behaviours among peri-urban households in Hanoi, K-means clustering identified two groups: “frequent buyers” (cluster 1; n = 71) and “low-frequency buyers” (cluster 2; n = 86). These clusters represent households with different food purchasing patterns, characterised by varying reliance on vendor types, purchasing frequency, and underlying motivations for vendor choice. As shown in Figure 7, frequent buyers are characterised by frequent food purchases from fresh markets, with most households shopping there daily. This cluster also showed moderate reliance on small grocery and convenience stores and speciality food shops, purchasing food from these outlets about twice a week on average. In contrast, low-frequency buyers purchased food less frequently across most vendor types. Still, fresh markets remained an important food source, but households visited them only five times per month on average. Small grocery and convenience stores were the second most important food source for the low-frequency households, but also at a lower average frequency, with two visits per month. Overall, frequent buyers made food purchases 55 times per month (almost twice daily), while low-frequency buyers made an average of 14 times per month (less than once every two days).

These differences suggest two distinct food acquisition patterns: one characterised by frequent, routine engagement with traditional food vendors, and another characterised by less frequent, more selective food purchasing across vendor types. However, both clusters shared fresh markets as the primary food source. This should be examined alongside the motivations underlying vendor choice across clusters, listed on the right side of the figure. Overall, both clusters show similar reasons for purchasing food from different vendors (Figure 7). For restaurants and wholesalers, both clusters prioritised quality and trust. Frequent-buyers additionally valued affordability and assortment, whereas low-frequency buyers placed more emphasis on proximity. For large supermarkets, assortment and quality were more important in both cases. Across both clusters, proximity was the primary factor influencing food vendor choice, being the most commonly reported motivation for visiting fresh markets, small grocery and convenience stores, specialty food shops, and street vendors. Both clusters prioritised similar vendor attributes: proximity, affordability, and assortment, with only minor variations. This suggested that behavioural segmentation based on frequency and motivations captured meaningful variations in food purchasing habits.

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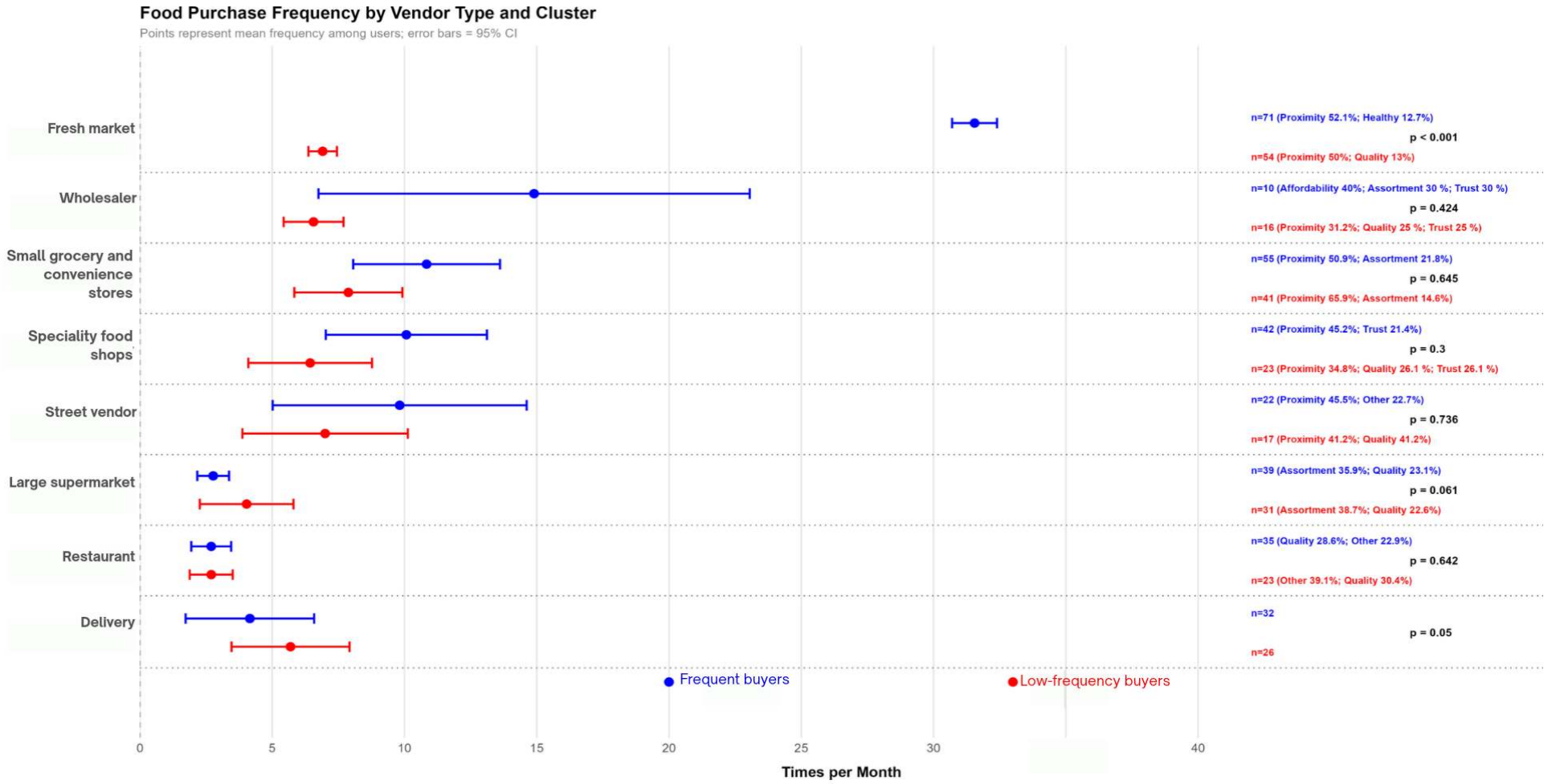

Figure 7 Frequency of food purchase per month by food vendor type and by cluster, right side indicating the most prominent reasons indicated by households (p-value refers to reported frequency to food vendors).
For statistics on all mentioned reasons, please see Appendix 1

Socioeconomic Profiles

The two clusters also differ in their socioeconomic profiles (Table 2). Cluster 1 ("Frequent buyers") households have lower average per capita monthly incomes (6,530,000 VND) compared to low-frequency buyers (8,660,000 VND). The gap between the mean and median in both clusters, especially among frequent buyers, indicates a skewed income distribution, with some higher-earning households pulling up the mean. Despite lower incomes, frequent buyers spend more on household food in absolute terms (6,690,000 VND), with monthly expenditures averaging 35.8% of their monthly household income. In contrast, cluster 2 ("Low-frequency buyers") allocates a smaller share of income to food (30.1% of their monthly household income), reflecting relatively higher financial security. The medians (22.5% for frequent-buyers, 22.3% for low-frequency buyers) are closer, suggesting the means are influenced by a subset of households with very high food expenditure-to-income ratios.

Table 2. Socioeconomic characteristics per cluster

	Frequent buyers (Cluster 1)	Low-frequency buyers (Cluster 2)
Monthly income	m: 25,200,000 ± M: 21,000,000 ± stdv: 20,000,000 IQR: 19,500,000	m: 31,300,000 ± M: 26,300,000 ± stdv: 20,000,000 IQR: 31,500,000
Income per capita (monthly)	m: 6,530,000 ± VND M: 4,360,000 ± stdv: 6,100,000 ± IQR: 4,630,000 ±	m: 8,660,000 ± VND M: 6,000,000 stdv: 10,000,000 ± IQR: 7,630,000 ±
Household food expenditure (monthly)	m: 6,690,000 ± VND M: 6,000,000 stdv: 4,080,000 ± IQR: 6,000,000	m: 6,650,000 ± VND M: 6,000,000 stdv: 4,460,000 ± IQR: 4,000,000
% food expenditure (monthly)	m: 35.8% M: 22.5% stdv: 30% IQR: 0.3%	m: 30.1% M: 22.3% stdv: 23.5% IQR: 0.2%
HDDS*	m: 6.38 M: 7 stdv: 1.93 IQR: 2	m: 5.78 M: 5 stdv: 2.09 IQR: 4
Average household size	m: 4.6 M: 4 stdv: 2.36 IQR: 2	m: 4.5 M: 4 stdv: 2 IQR: 3
Female respondents*	m: 53.5%	m: 72.1%
Number of female adults in household	m: 1.8 M: 2 stdv: 0.9 IQR: 1	m: 1.5 M: 1 stdv: 0.7 IQR: 1
Number of male adults in household	m: 1.7 M: 1 stdv: 0.8 IQR: 1	m: 1.6 M: 1 stdv: 0.8 IQR: 1
Number of children in household	m: 1.2 M: 1 stdv: 1.6 IQR: 2	m: 1.4 M: 1 stdv: 1.3 IQR: 2
Participation in urban agriculture	m: 27% M: 0% stdv: 45% IQR: 1	m: 21% M: 0% stdv: 0.4% IQR: 0
Size of farm (m2)	m: 626.43 M: 200 stdv: 993.94 IQR: 737.5	m: 431.94 M: 108 stdv: 889.93 IQR: 288
Percentage of food consumption from own production	m: 25.7% M: 10% stdv: 30.6% IQR: 46.5%	m: 35.6% M: 27.5% stdv: 29.7% IQR: 38.8%
Participation of men in urban agriculture[4]	m: 68.4% M: 100% stdv: 74.9% IQR: 1	m: 72.2% M: 66.9% stdv: 100% IQR: 1
Participation of women in urban agriculture[4]	m: 100% M: 100% stdv: 57.7% IQR: 0	m: 83.3% M: 100% stdv: 61.8% IQR: 0.8
Participation of children in urban agriculture[4]	m: 5.2% M: 0% stdv: 22.9% IQR: 0%	m: 5.6% M: 0% stdv: 23.6% IQR: 0%
Households that hire farming staff (n & %)[4]	n: 0 (0%)	n: 3 (16.7%)
Receives food from food-sharing activities	m: 59.7% M: 100% stdv: 49.5% IQR: 100%	m: 78.8% M: 100% stdv: 41.5% IQR: 0%
Gives food as part of food-sharing activities	m: 71.9% M: 100% stdv: 45.3% IQR: 100%	m: 79.7% M: 100% stdv: 40.5% IQR: 0%

1. Standard deviation (stdv) is reported for means and interquartile ranges for medians.
2. Among the 18 households in cluster 2 that participate in urban agriculture, 3 (16.7%) hire farming staff; one hires 2 workers and two hire 1 worker.
3. 24,260 VND = 1USD (exchange rate as of October 2024).
4. Values are based only on the number of households that reported participating in urban agriculture.

m = mean, M = median, stdv = standard deviation, IQR = interquartile range, n = number.
* ($p < 0.05$)

Household size is comparable across clusters (4.6 for frequent buyers and 4.5 for low-frequency buyers), as is the composition of female and male adults and children, suggesting that observed differences in food purchasing patterns are not primarily driven by household composition. However, survey respondents showed a notable gender imbalance, with low-frequency buyers having a higher

proportion of female respondents (72.1% in low-frequency buyers versus 53.5% in frequent buyers). This might suggest that, although surveys also took place on weekends, most were administered during the day, when more female household members were at home, and male household members may have been less interested in participating.

About one in four survey participants were involved in urban agriculture: 27% were frequent buyers, and 21% were low-frequency buyers. Among those who participated, frequent buyers operate larger plots on average (643.43 m2) than low-frequency buyers (431.94 m2), although large standard deviations suggest variability and the presence of a few very small plots. Despite smaller farm sizes, low-frequency buyers report a higher share of own-production consumption (35.6%) than frequent buyers (25.7%). Participation patterns also differ within households. Women's and men's participation in urban agriculture was high in both clusters, with women having a higher participation rate in both cases. Low-frequency buyers involved hired farming staff, whereas frequent buyers did not. About 5% of farming households also involved (some) of their children in agricultural activities.

Dietary diversity

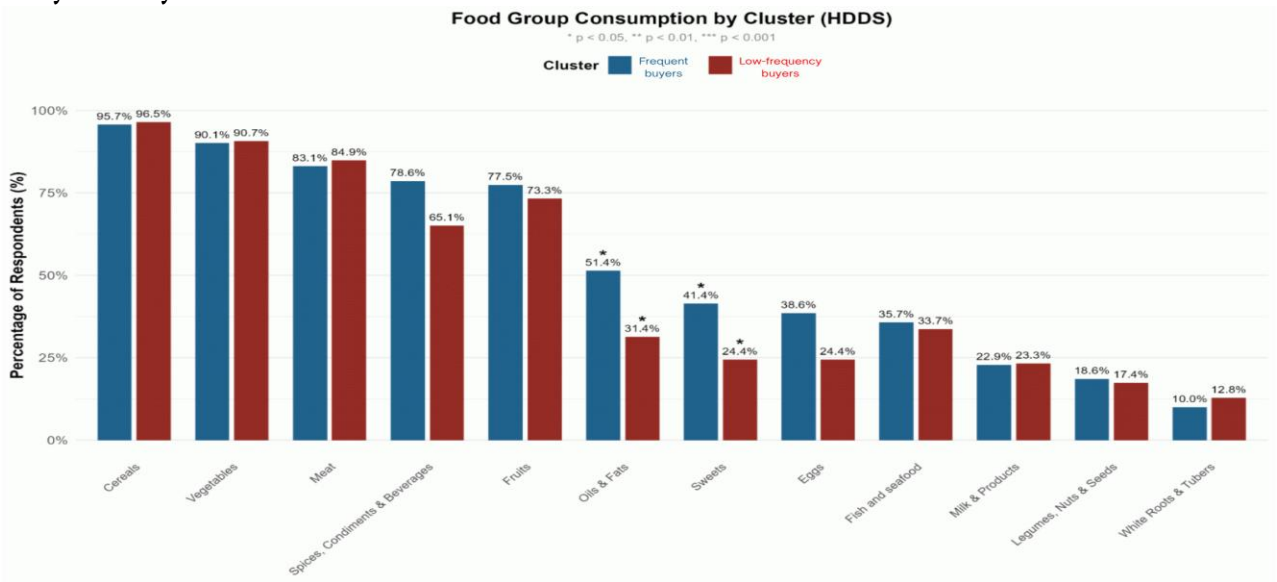

Figure 8. Frequency of food consumption per food group based on household dietary diversity score (HDDS: Kennedy et al., 2010).

Dietary diversity, measured using a household dietary diversity score (HDDS) (Kennedy et al., 2010) based on a 24-hour recall period, shows modest differences between clusters (Figure 8). Frequent buyers had a slightly higher average HDDS (6.38) than low-frequency buyers (5.78), despite lower income levels, but the difference was not statistically significant ($p = 0.063$). In addition, compared with low-frequency buyers, frequent buyers reported significantly higher consumption of oils and fats (51% more, $p = 0.011$) and sweets (41% more, $p = 0.024$), possibly indicating greater reliance on (ultra-)processed or convenience foods.

Spatial accessibility

We assessed spatial accessibility to food vendors using the minimum travel time from households to each vendor type, calculated in QGIS with the QNEAT3 toolbox and compared with reported travel times by household respondents. Average self-reported travel times were generally short in both clusters, with households reaching wholesalers in about 7 minutes, local markets, fresh markets, and speciality food shops in about 5–6 minutes, and restaurants in 11–13 minutes (Table 3). The travel times were generally similar for frequent and low-frequency buyers.

Integrating means of transport (Figure 9) and vehicles owned (Table 4) provides additional nuance. Frequent buyers owned, on average, 0.39 cars, 2.37 motorcycles and 1.72 bicycles. On the other hand, low-frequency buyers owned 0.51 cars, 2.12 motorcycles and 1.13 bicycles, though only bicycle ownership presented a statistically significant difference.

Figure 9 shows how people travel to each type of vendor. For small grocery and convenience stores, walking was the most common mode in both clusters (45.5% of frequent buyers and 58.5% of low-frequency buyers), though a substantial share also used motorcycles (36.4% and 22%, respectively). For fresh markets, walking dominated among frequent buyers (45.1%) but was less dominant among low-frequency buyers (22.2%), who more often used bicycles (22.2%) or motorcycles (48.2%). Motorcycles were the primary mode for accessing large supermarkets in both clusters, used by 69.2% of frequent buyers and 48.4% of low-frequency buyers. Low-frequency buyers also used cars to reach large supermarkets (25.8%), compared to only 12.8% of frequent buyers. Public transport and taxis were rarely used in either cluster, highlighting reliance on private and non-motorised modes.

Table 3: Average distance to food vendors per cluster in km and minutes

Vendor type	Cluster	Average travel time reported by households (in minutes)	Average distance to nearest vendor in km (QGIS analysis)
Fresh market	1	m: 5:34 stdv: 4:35	m: 1.77 stdv: 0.56
	2	m: 6:05 stdv: 3:44	m: 1.71 stdv: 0.53
Small grocery and convenience stores	1	m: 5:06 stdv: 2:55	m: 0.51 stdv: 0.47
	2	m: 5:00 stdv: 2:49	m: 0.48 stdv: 0.41
Speciality food shops	1	m: 6:00 stdv: 4:17	m: 0.51 stdv: 0.47
	2	m: 7:23 stdv: 6:01	m: 0.48 stdv: 0.41
Wholesaler	1	m: 7:47 stdv: 7:01	m: 2.87 stdv: 1.75
	2	m: 7:19 stdv: 9:08	m: 2.82 stdv: 1.8
Restaurant	1	m: 11:54 stdv: 6:22	m: 0.54 stdv: 0.42
	2	m: 13:42 stdv: 6:28	m: 0.43 stdv: 0.4
Street vendor	1	m: 4:11** stdv: 2:49	m: 0.69 stdv: 0.58
	2	m: 10:49** stdv: 6:42	m: 0.60 stdv: 0.58

Cluster 1 = Frequent buyers; Cluster 2 = Low-frequency buyers; *m = mean, stdv = standard deviation.* ** *(p < 0.001)*

Table 4. Vehicles owned by household per cluster

	Frequent buyers (Cluster 1)	Low-frequency buyers (Cluster 2)
Car ownership	m: 0.4 M: 0 stdv: 0.6 IQR: 1	m: 0.5 M: 0 stdv: 0.6 IQR: 1
Motorcycle ownership	m: 2.4 M: 2 stdv: 1.3 IQR: 2	m: 2.1 M: 2 stdv: 1.6 IQR: 2
Bicycle ownership**	m: 1.7 M: 1 stdv: 1.5 IQR: 1	m: 1.1 M: 1 stdv: 1 IQR: 2

m = mean, M = median, stdv = standard deviation, IQR = interquartile range
* (p < 0.05) ** (p < 0.001)

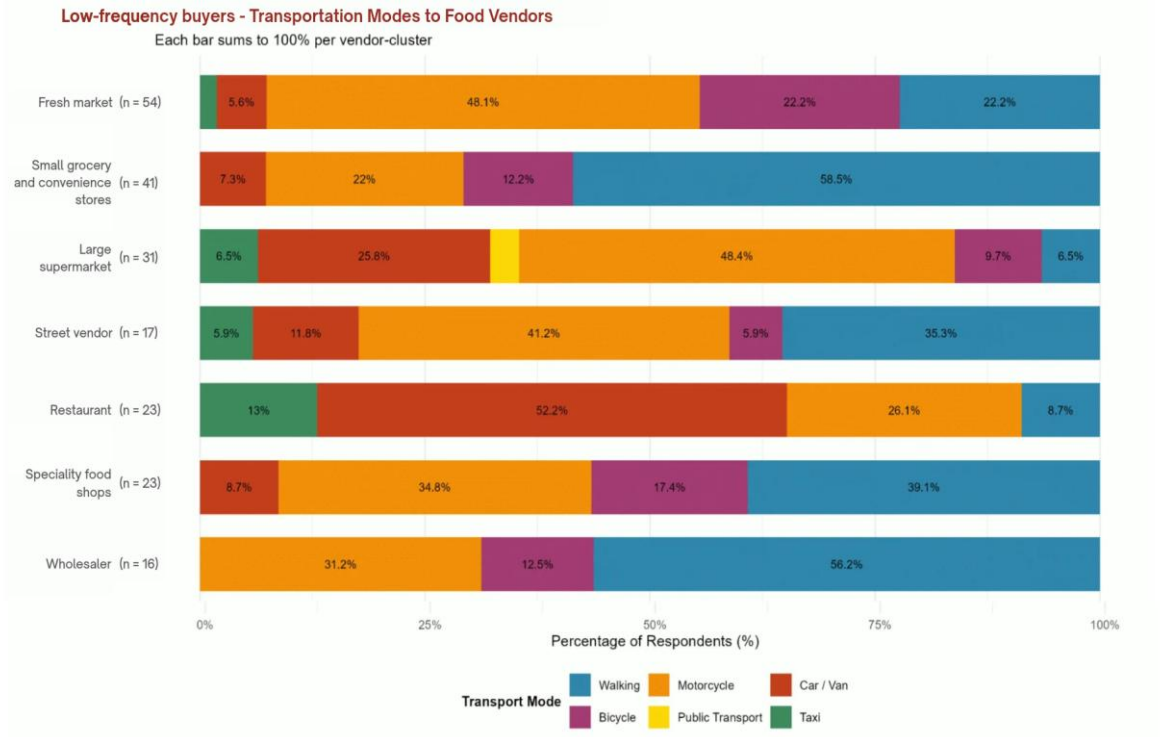

Figure 9. Frequency of means of transport to food vendors per cluster.

Discussion

This study assessed whether food consumption and socioeconomic characteristics differed across peri-urban households in Hanoi (Vietnam) by comparing two household clusters: frequent buyers and low-frequency buyers. Within the frequent-buyer cluster, higher household food expenditure, relatively lower income per capita, and lower representation of female respondents suggest that more household members may have engaged in income-generating activities, increasing demand for convenient, processed food options. Frequent buyers purchase food about 55 times per month, compared with 14 times among low-frequency buyers (Figure 7). These frequent-buyer households may have exercised agency by substituting home cooking with purchased convenience foods, though such choices may have been constrained by labour market participation and limited time. Rapid urbanisation in LMICs is associated with changing socioeconomic dynamics, including increased workforce participation, longer commuting times, and time-consuming reproductive activities, all of which reduce the time available for home cooking (Colozza et al., 2023; Popkin & Ng, 2022; Tacoli, 2017). Taken together, these patterns support the hypothesis that lower-income households may rely on broader workforce participation to sustain livelihoods, thereby reducing time available for meal preparation and increasing dependence on externally prepared or convenience foods (Colozza et al., 2023; Popkin & Ng, 2022; Popkin et al., 2020; Tacoli, 2017). However, this study did not explicitly take workforce participation or time available for meal preparation into account.

Both clusters shared fresh markets as their primary food source, consistent with previous studies highlighting the central role of traditional markets in Southeast Asian food environments (Barthelmes, 2015; Cheung et al., 2021; Hofman & Trevenen-Jones, 2024; Huynh, 2023; Truong, 2018; Raneri & Wertheim-Heck, 2019; Ranieri et al., 2019; Wertheim-Heck & Raneri, 2020). Studies in the Vietnamese urban context have documented why households continue to purchase daily from fresh markets despite the rise of supermarkets, pointing to deeply embedded practices and perceptions about freshness, taste, time constraints, trust, and affordability (Figuié et al., 2019; Tran, 2023). When citing the reasons why they frequented these food outlets, both clusters prioritised proximity, followed by affordability, and a good assortment of foods offered. This aligns with previous research from Vietnam showing that geographical proximity alone does not define consumer dietary behaviour, as other factors, including perceptions about diet, food safety, lifestyles, and daily routines also play an important role in food consumption patterns (Wertheim-Heck & Raneri, 2020; Raneri et al., 2019).

The findings therefore indicate that differences between clusters were not rooted in fundamentally different food choice motivations. Rather, these shared motivations are operationalised differently under varying socioeconomic and temporal constraints within the personal food environment (Turner et al., 2018). In frequent buyers, their regular visits to fresh markets, street vendors, and other nearby outlets suggest that food provisioning is embedded in routine, time-sensitive practices. The external domain (availability, prices) was similar for both clusters, but the personal domain, specifically income, time, and mobility constraints, differentially shaped how households enact those shared preferences. Thus, food purchasing frequency becomes not merely a reflection of preference, but of structural conditions

shaping everyday life (Even et al. 2025a; Figuié et al., 2019; HLPE, 2020; Phuong et al., 2025 Wertheim-Heck et al., 2019).

The spatial analysis reinforced the interpretation that physical proximity to the external food environment alone does not account for behavioural differences between consumers. Average travel times to most vendor types are comparable across clusters, and the relatively modest differences suggested that in Long Biên proximity to food sources is unlikely the sole driver of differences in household food purchasing patterns, as previous studies in Vietnam have reported (Figuié et al., 2019; Gaupholm et al., 2022; Raneri & Wertheim-Heck, 2019; Wertheim-Heck & Raneri, 2020; Nguyen et al., 2021). The observed patterns in transport modes further highlight physical accessibility as an important factor mediating food choice (Turner et al., 2018). Low-frequency buyers relied more on cars to access large supermarkets (25.8% vs 12.8%), suggesting a higher capacity for bulk purchases. In contrast, frequent buyers depend more on motorcycles and walking which may have favored smaller, more frequent shopping trips integrated into daily routines. These patterns may reflect variations in household labour allocation, trip chaining, and the availability of personal transport, which interact with income, household composition, and time constraints to shape food acquisition strategies. The interaction between spatial accessibility, reliance on walking and motorcycles, and time constraints appears to structure food purchasing habits. In this sense, food access appeared to be influenced not only by income or distance (Nguyen et al., 2021), but by the temporal organisation of work and household responsibilities.

The higher consumption of oils and fats, sweets, and spices, condiments, and beverages among frequent buyers, may indicate a greater reliance on (ultra-)processed or convenience foods. This pattern may reflect limited time for meal preparation due to time constraints (Tacoli, 2017), a decrease in the affordability of healthy products relative to ultra-processed foods (Even et al., 2025b; Harris et al., 2020), and a resulting broader increase in the consumption of ultra-processed food (Béné et al., 2026; Popkin & Ng, 2022; Zanello et al., 2026). Furthermore, these results are consistent with the hypothesis that households with distinct purchasing habits exhibit different levels of dietary diversity.

Ongoing dietary shifts in Vietnam, including transition towards more (ultra-)processed and convenience-oriented foods and westernised meals, are shaped by these changing urban lifestyles, time constraints and the supermarketisation of the food environment (Popkin & Ng, 2022; Raneri et al., 2019; Wertheim-Heck et al., 2019). These findings provided descriptive evidence concerning the "missing middle" (Harris et al., 2020), showing that upstream drivers like income are not the sole determinants of dietary outcomes and purchasing habits. Personal preferences and structural conditions, like time constraints, appear to be important associated factors. However, whether these factors mediate the relationship between upstream drivers and dietary diversity needs to be addressed by future research.

The urban agriculture findings add further nuance. Despite smaller farm sizes on average, low-frequency buyers reported higher production for consumption, possibly for quality control or preference, rather than income diversification (Pham & Turner, 2020). The involvement of hired farming staff in low-frequency buyers further suggested that, in some cases, they operate at a more intensive scale. In contrast, frequent buyers reporting lower self-consumption from their agricultural land suggests a more market-oriented approach, consistent with patterns observed among lower-income households in LMICs who may use urban agriculture to diversify household income (Pulliat, 2015; Satterthwaite et al., 2010).

Given the central role that traditional, modern, informal and formal vendors play in sustaining frequent food purchases among time-constrained households, their inclusion in urban food access policies becomes essential. As highlighted in previous research, traditional food vendors constitute a critical component of dietary intake in rapidly urbanising settings (Atomei, 2017; Barthelmes, 2015; Huynh, 2023; Nguyen et al., 2021; Raneri et al., 2019; Steyn et al., 2014; Wertheim-Heck & Raneri 2020). Policies that overlook these vendors risk neglecting the everyday infrastructures through which lower-income working households secure meals (Atomei, 2017; Even et al., 2025a; Figuié et al., 2019; Harris et al., 2020; Huynh, 2023; Tacoli, 2017; Truong, 2018). Integrating informal and traditional vendors into urban planning frameworks, while promoting healthy food options and adequate sanitary standards, may therefore contribute to more equitable and context-sensitive food environments in rapidly urbanising LMICs while supporting livelihoods (Tacoli, 2017; Tran, 2023). Without inclusive urban food planning, the displacement of these vendors will likely exacerbate inequalities and reduce food access for vulnerable groups. Any reduction in access to fresh food markets may reduce the overall nutritional and health-promoting quality of diets. Promoting coexistence and complementarity between informal and formal food environments is therefore key to achieving sustainable urban food security.

Limitations

This study has several limitations. First, our analysis relied on a combination of interviews about food purchasing habits with primary and secondary spatial data, including OpenStreetMap, as comprehensive official datasets of food vendors were not available. While vendor locations were cross-checked and validated using Google Streetview, the absence of a full registry may introduce uncertainties in estimated travel times or vendor coverage. Additionally, food vendor classification varies across contexts, as there is no consensus on how to refer to them across Southeast Asia (Atomei, 2017). Distinctions between local markets, fresh markets, speciality food shops, and informal vendors may therefore differ by setting, which should be considered when interpreting the findings. For instance, while enumerators logged 23 food trucks in the study area, households may have described them as street vendors or restaurants. Given this uncertainty, we excluded food trucks from the analysis.

In addition, the household survey did not capture employment status or time spent outside the home, which this study identified as likely relevant for understanding time constraints and food purchasing patterns. Furthermore, the HDDS captures only 24-hour food group variety. It may not reflect day-to-day or seasonal differences in the diet and does not measure individual nutritional intake or portion sizes, limiting its ability to fully characterise diet quality. Moreover, although our study did not assess food marketing in household purchasing patterns, the informational and marketing dimension of the external food environment also warrants attention because consumers need it to make informed choices (Turner et al., 2018; Priya & Alur, 2023). In Vietnam, front-of-pack nutrition labelling remains largely unregulated and inconsistent, leaving consumers with limited standardised tools to distinguish healthier from less healthy food products (Even et al., 2025b). These marketing strategies may reinforce the appeal of convenience foods, especially for time-constrained households. Future research could incorporate these measures to further elucidate the interplay between time use, dietary practices, marketing and gender roles in rapid urbanisation contexts in LMICs. Using multivariable approaches, scholars could clarify the relative importance of income, proximity and behavioural segmentation to dietary diversity.

Conclusions

This paper examined how food purchasing practices and spatial access to food vendors related to dietary diversity among households in Long Biên. Rather than framing food access primarily in terms of income or residential location, the analysis adopted a behaviour-based perspective by identifying household food-purchasing strategies based on purchase frequency, vendor choice, transportation use, and stated motivations for vendor choice. A K-means cluster analysis distinguished two household types: one characterised by frequent, routine purchases from traditional food vendors, and another defined by less frequent, more selective purchasing across vendor types. Both clusters relied primarily on fresh markets as their main food source and showed similar household size and composition, but differed in income, food expenditure share, and respondent gender. Households in the less frequent purchasing cluster were, on average, wealthier. Frequent purchasers showed higher dietary diversity, but this may not reflect the nutritional value of their diets because it appeared driven by greater consumption of oils, fats, and sweets. However, the HDDS capture was based on a 24-hour recall period and may therefore not reflect habitual dietary patterns. No significant differences were found in distance-based spatial access to food vendors, although transport modes varied between clusters.

These findings suggest that the observed differences in purchase frequency were not driven by divergent food choice motivations, as both clusters prioritised proximity, affordability, and product assortment. Instead, they achieved these shared priorities differently under varying socioeconomic and time constraints. Future research should explore this further by assessing intra-household gendered divisions of employment and household maintenance and by including survey questions about household time budgets. Our findings suggest that policymakers should be cautious in enacting policies likely to displace informal and traditional food vendors. Supermarketisation can inadvertently worsen dietary quality, especially for time-constrained and low-income households who depend on frequent, accessible and affordable purchases. These results highlight the importance of recognising informal food vendors as integral components of urban food environments. Integrating these vendors into urban planning and policy frameworks, while supporting food safety and healthy food availability, may contribute to more equitable and context-sensitive food environments in rapidly urbanising low- and middle-income cities.

Author Contributions

ARRJ and LMH: Joint first authorship. ARRJ: Writing – review & editing, Writing – original draft, Visualisation, Formal and statistical analysis. LMH: Writing – review & editing, Writing – original draft, Supervision, Project administration, Funding acquisition, Data curation, Conceptualization. TTHH: Writing - review & editing. KCV: Writing - review & editing, Supervision. All authors then critically reviewed the following versions. All authors have read and approved the final version of the paper and its submission and have given consent for publication.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

During the preparation of this work, the authors used ChatGPT version 4 by OpenAI and Microsoft Copilot version 2.2 in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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Data Availability Statement

All relevant data are available within the manuscript

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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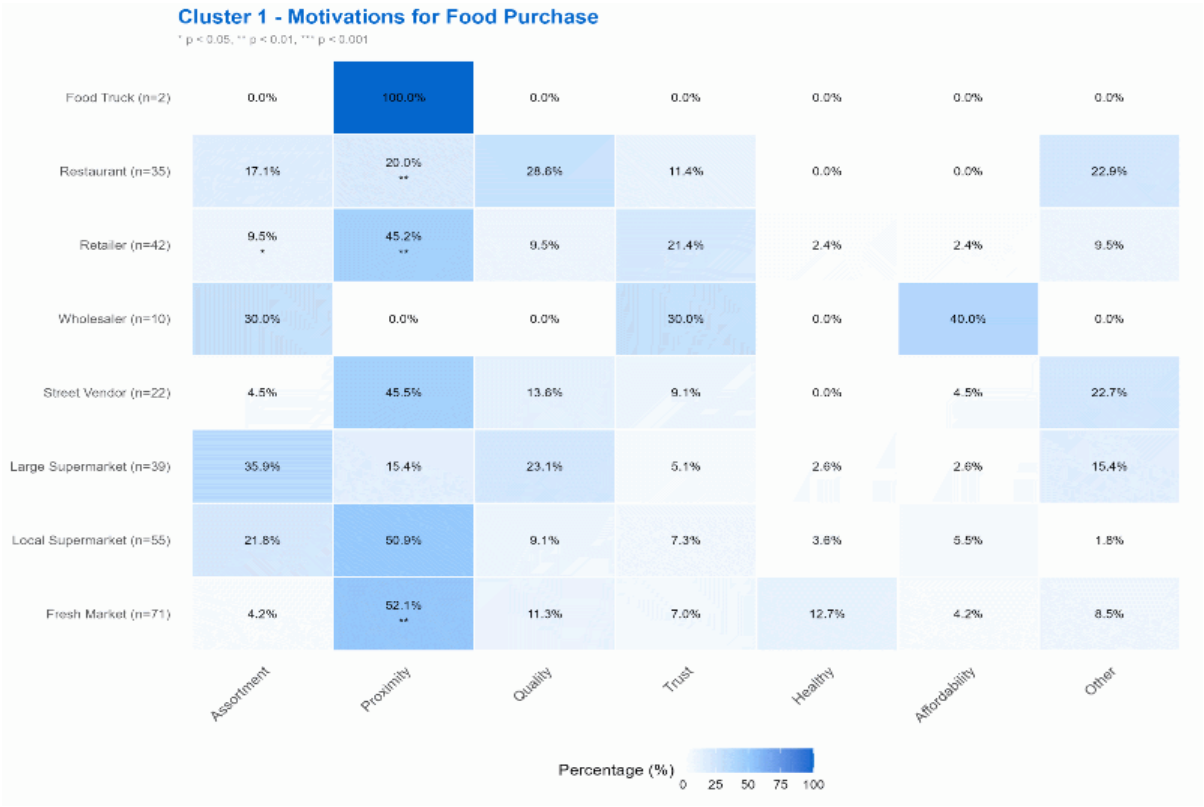
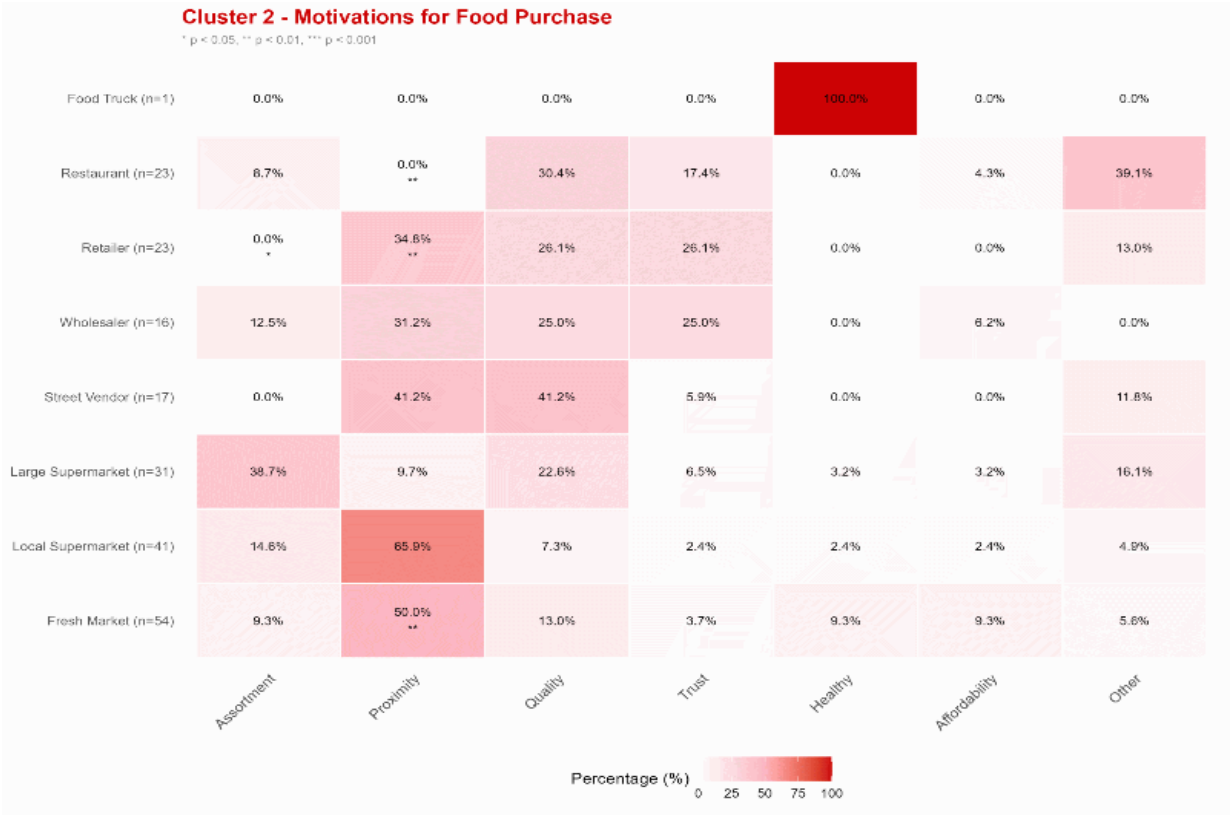
Supplementary materials

Appendix 1. Reasons for purchasing from food vendors per cluster





Appendix 2. Survey instrument

Variable Name	Survey Question (English)	Input Options
location	IMPORTANT: Please register the GPS LOCATION for this survey before you knock.	GPS coordinates
total	How many people live in this house?	Numerical value
men	Number of adult males:	Numerical value
women	Number of adult women:	Numerical value
children	Number of children:	Numerical value
resp_gender	Gender of the respondent	Female; Male; (Non-binary, Nonconforming, Fluid, prefer not to say)
foodsharing_activity	Do you ever receive or give food from/to neighbors, relatives, school, church or other sources?	Yes, we sometimes receive food (e.g. from family, neighbors, friends, church, school, etc.); Yes, we sometimes give away food (e.g. to family, neighbors, friends, church, school, etc.); No, we do not share food or receive food from anyone
farms	Does this household produce any food or other agricultural products (whether sold or consumed)?	Yes; No
consumptionpercentage	Can you estimate the percentage (%) of your family's food intake that comes from your own garden/farmland?	Numerical value
farmsize	Can you provide an estimated sizeof the garden/agricultural land you are cultivating in m^2?	Numerical value
farmersmen	Number of adult males:	Numerical value
farmingwomen	Number of adult women:	Numerical value
farmingchildren	Number of children:	Numerical value
farmingstaff	Number of employees/staff/helpers:	Numerical value
HDDS (Household Dietary Diversity Score)	Question: Please describe the food (meals and snacks) you ate or drank yesterday during the day and evening, both at home and away from home. Start with the first food or drink of the morning. *Method: Enumerator ticks all that were mentioned then probes for unmentioned categories, snacks. Possible answers are YES; NO for each of the 16 categories. Fruits and vegetable categories are merged afterwards as per the HDDS methodology, leaving 12 categories.*	
	CEREALS (corn, rice, wheat, bread, noodles, porridge, pasta, etc…);	
	WHITE ROOTS AND TUBERS (potatoes, white sweet potato, white cassava, quack, Chinese tayer … or other roots);	
	VEGETABLES AND TUBERS WITH VITAMIN A (pumpkin, carrot, orange sweet potato, pepper (anything that is orange on the inside));	
	DARK GREEN LEAFY VEGETABLES (clary, cassava leaves, spinach, amchoi, bok choy, cabbage, bitawiri all leaves…);	
	OTHER VEGETABLES (tomato, onion, eggplant/boulanger, poe, sopropo, antroea, soekwa, ocher, broccoli…);	
	FRUIT WITH VITAMIN A (mango, melon, papaya, watermelon, passion fruit/makoesa, grapefruit, sapotille or 100% juices thereof);	
	OTHER FRUIT (banana/baking oven, orange, acai, berries, cherries, dragon fruit, lychee/rambutang, apple, pomerak, lime … or 100% juices thereof);	
	ORGAN MEAT (liver, kidney, heart or other organ meat or blood-based food);	
	OTHER MEAT (beef, pork, lamb, goat, rabbit, game, chicken, insects…);	
	EGGS (chicken, duck or other);	
	FISH AND SEAFOOD (fresh or dried fish or shellfish);	
	LEGUMES, NUTS AND SEEDS (beans, long beans, peas, lentils, sim, nuts, seeds, peanuts or food made from these);	
	MILK AND MILK PRODUCTS (milk, cheese, yogurt or others);	
	OILS AND FATS (oil, fats or butter added to food or used for cooking);	
	SWEETS (sugar, honey, sweetened soft drinks or sweetened fruit juices, sugary foods such as chocolate, sweets, cookies and cakes);	
	SPICES, CONDIMENTS, BEVERAGES (spices, pepper, salt, soy sauce, hot sauce, coffee, tea, alcoholic drinks)	

Variable Name	Survey Question (English)	Input Options
supermarket_freq	How often do you (your family) go to a local/small/neighborhood SUPERMARKET to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food at this particular SUPERMARKET?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What means of transport do you usually use to go to this SUPERMARKET?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this SUPERMARKET, in minutes? (travel time)	Numerical value
largesupermarket_freq	How often do you (your family) go to a large/chain SUPERMARKET to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food at this specific large/chain SUPERMARKET?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What means of transport do you usually use to go to this large/chain SUPERMARKET?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this large/chain SUPERMARKET, in minutes? (travel time)	Numerical value
market_freq	How often do you go to a fresh MARKET to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food in this particular MARKET?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What means of transport do you usually use to go to this MARKET?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this MARKET, in minutes? (travel time)	Numerical value
streetven_freq	How often do you go to a STREET VENDOR/stall to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food from this particular STREET VENDOR/stall?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What mode of transport do you usually use to go to this STREET VENDOR/stall?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this STREET VENDOR/stall, in minutes? (travel time)	Numerical value
wholesaler_freq	How often do you go to a WHOLESALER to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food from this particular WHOLESALER?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What means of transport do you usually use to get to this WHOLESALER?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car

Variable Name	Survey Question (English)	Input Options
time	Approximately how long does it take you to get to this WHOLESALER, in minutes? (travel time)	Numerical value
retail_freq	How often do you go to a RETAILER (bakery, butchery…) to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food in this specific RETAILER (bakery, butchery…)?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	Which means of transport do you usually use to go to this RETAILER (bakery, butcher's shop…)?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this RETAILER (bakery, butcher's shop…), in minutes? (travel time)	Numerical value
resto_freq	How often do you go to a RESTAURANT (dine-in) to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you purchase/gather food at this particular RESTAURANT (dine-in)?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What mode of transportation do you usually use to get to this RESTAURANT (dine-in)?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this RESTAURANT (dine-in), in minutes? (travel time)	Numerical value
foodtruck_freq	How often do you go to a FOOD TRUCK to access food?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
reason	What is the main reason you buy/gather food in this specific FOODTRUCK?	I know this supplier/source personally (trust); They are the cheapest; It's close; They have healthy options; They have good quality products; They offer a large and/or unique assortment, variety; Other (specify)
transportation	What mode of transportation do you usually use to get to this FOOD TRUCK?	Is home; On foot; By bicycle; With a scooter or motorbike; Bus/public transport; Taxi/uber; I'm hitching a ride with someone/someone brings me; Own car or minivan; Company car
time	Approximately how long does it take you to get to this FOOD TRUCK, in minutes? (travel time)	Numerical value
order_freq	How often do you order food online for delivery at your home, either using an app (for example Grab), or directly from the restaurant (phone, website)?	Several times a day; 1x daily; Several times a week; 1x per week; 2-3x per month; 1x monthly; Rarely/never
foodexpenditure	How much Vietnamese Dong (VND) does your household spend on food on average per day/week/month?	Open text response (afterwards cleaned for numerical value only)
foodexp_timeunit	${foodexpenditure} Vietnamese Dong (VND) per:	Day; Week; Month
income	What is the estimated total monthly family income in Vietnamese Dong (VND)? (i.e. the monthly income of all working household members combined)	< 800k VND; 800k – 1,5 mil; 1,5 mil – 2,5 mil ; 2,5 mil – 3,5 mil ; 3,5 mil – 5 mil ; 5 mil – 7 mil ; 7 mil – 10 mil ; 10 mil – 12 mil ; 12 mil – 14 mil ; 14 mil – 16 mil ; 16 mil – 18 mil ; 18 mil – 22 mil ; 22 mil – 26 mil ; 26 mil – 35 mil ; 35 mil – 50 mil ; 50 mil – 100 mil ; > 100 mil VND
car	Car/car (including company car):	Numerical value
motorcycle	Motorcycle/scooter:	Numerical value
bicycle	Bicycle:	Numerical value