

Factors Affecting of Fruit and Vegetable Intake Among Adults: A Scoping Review.

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Abstract: Fruits and vegetables (FV) are crucial for a healthy diet. The World Health Organization (WHO) suggests that adults should consume at least five (5) servings of fruits and vegetables daily. This study aims to identify the factors that impact of fruit and vegetable intake among adults in Malaysia and Asian countries. The conceptual framework for this study is based on the Social Cognitive Theory by Bandura, which serves as the foundation of our approach to understanding personal, behavioural, and environmental factors that influence the consumption of FV. The researchers selected articles published between 2000 and 2020 using various databases such as PubMed/Medline, Scopus, Elsevier/EMBASE, Google Scholar, Cochrane Library, and grey literature. They included a total of 21 studies and summarized the existing evidence for each identified factor across the different levels. The study found that high prices, parental control, and family influence are the primary factors that impact the fruit and vegetable intake. Lack of access and limited options for FV in residential areas and workplaces also negatively impact FV consumption. The study concluded that environmental factors are the most important, followed by personal and behavioural factors in influencing FV eating behaviour. This scoping review provides valuable information from various studies.

Keywords: Affecting, fruit, vegetables, adults, intake

1. Introduction

Consuming fruit and vegetable (FV) is essential for maintaining good health. Inadequate intake of these food items has been linked to poor health and an increased risk of non-communicable diseases (NCDs), which caused 3.9 million deaths globally in 2017. FV are rich in essential vitamins, minerals, dietary fibers, plant sterols, flavonoids, antioxidants, and other non-nutrient substances that are beneficial for our health. To ensure that you get an adequate intake of these essential nutrients, it is recommended to consume a variety of fruits and vegetables that added up to more than 400 grams per day. This also helps in maintaining an overall healthy diet that is low in fat, sugars, and sodium (WHO 2019).

Different countries have their own dietary recommendations regarding fruit and vegetable intake. The recommended quantities may vary from country to country. The actual intake is closely linked to socioeconomic status and educational level. Some guidelines are based on food groups, whereas others provide recommended nutrient intakes, sometimes including nutrient supplementation (Estaquio et al., 2019).

This scoping review aims to provide a comprehensive overview of the various factors affecting fruit and vegetable intake among adults. By systematically mapping and synthesizing existing literature, this review seeks to identify key determinants that influence individuals' dietary choices and behaviors related to fruit and vegetable consumption. Through a systematic exploration of the existing literature, this scoping review seeks to identify gaps in current knowledge and areas for further research, ultimately guiding future efforts to address the multifaceted challenges of improving fruit and vegetable intake among adults.

2. Materials and Methods

The article selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram (Moher et al., 2009). We conducted searches in electronic databases including

PubMed/Medline, Scopus, Elsevier/EMBASE, Google Scholar, Cochrane Library, and grey literature. Our comprehensive search strategy focused on identifying articles with abstracts that mentioned the following four key terms: (1) Adults, AND (2) Fruit and Vegetables, AND (3) ASIAN, AND (4) Malaysia. The review included studies conducted in Malaysia, Vietnam, Singapore, Korea, Laos, Japan, Bangladesh, Brunei, Thailand, Indonesia, China, and Sri Lanka. We excluded other countries due to differences in social and cultural practices, political systems, and extreme landscapes. The search was undertaken between January 2020 and December 2020. The database was not subjected to any limits or filters in order to avoid unintentionally excluding any papers of interest.

Selection Process

The eligibility of the results was assessed by reviewing the title, abstract, and full text. NA and ABR autonomously assessed the article's suitability based on the inclusion criteria. The following inclusion criteria were applied as follows:

- Limits article published in year 2000 to 2020
- The method involves in quantitative and qualitative
- Adults aged 18-59 years old

For this review, this study utilized original Malay and English papers, as well as grey literature including technical reports and local theses. However, it did not include newspaper cuttings and magazines. The study also made use of library databases and relevant websites such as WHO, Ministry of Health Virtual Library, Ministry of Agriculture (MARDI), etc. to identify relevant studies. No authors were further contacted.

Data Charting and Synthesis

Before doing the initial search, researchers NA, NJ, ABR, NAJ, and SRH had a discussion about the search terms and databases to be used. Every researcher was granted access to a shared excel spreadsheet that recorded all search activities. After a thorough discussion involving all five researchers, the NA and NAJ carried out a final search using revised search criteria in the same databases. After identifying relevant studies according to the specified inclusion and exclusion criteria, they were retrieved and screened. A preliminary extraction template was created, and the features of the study were exported. The following variables were collected from each study: first author, year, title, journal, type of study, participant number, age, location, findings, and conclusion. Researchers altered the extraction template by selectively focusing on the data they deemed significant and pertinent to the study's objectives. The five reviewers reached a consensus on a final extraction template that encompassed the research features of the final full-text studies. The findings, which indicate the facilitating or impediments, are shown in **Table 1** and include information on the author, country, and findings that identify the facilitating or barriers. Researchers unanimously identified common themes, collected data from each study pertaining to these themes, and subsequently organized them for analysis

The data from various studies was extracted by five authors (NA, NJ, ABR, NAJ, SFH). They recorded details about the study population, context, aim and methods, intervention strategies, mechanisms (if available), key success factors, barriers to implementation, and impacts. The studies were categorized based on the Social Cognitive Theory (Bandura, 1986), which focuses on three domains: personal factors, behavioural factors, and environmental factors, and their influence on fruit and vegetable consumption behaviour. As the review methodology was a scoping review, a formal quality assessment was not conducted due to the small number of papers and the heterogeneity of topics and study types. Finally, reviewers assessed the full texts of each article for final inclusion. See Figure 1 for the overall selection process.

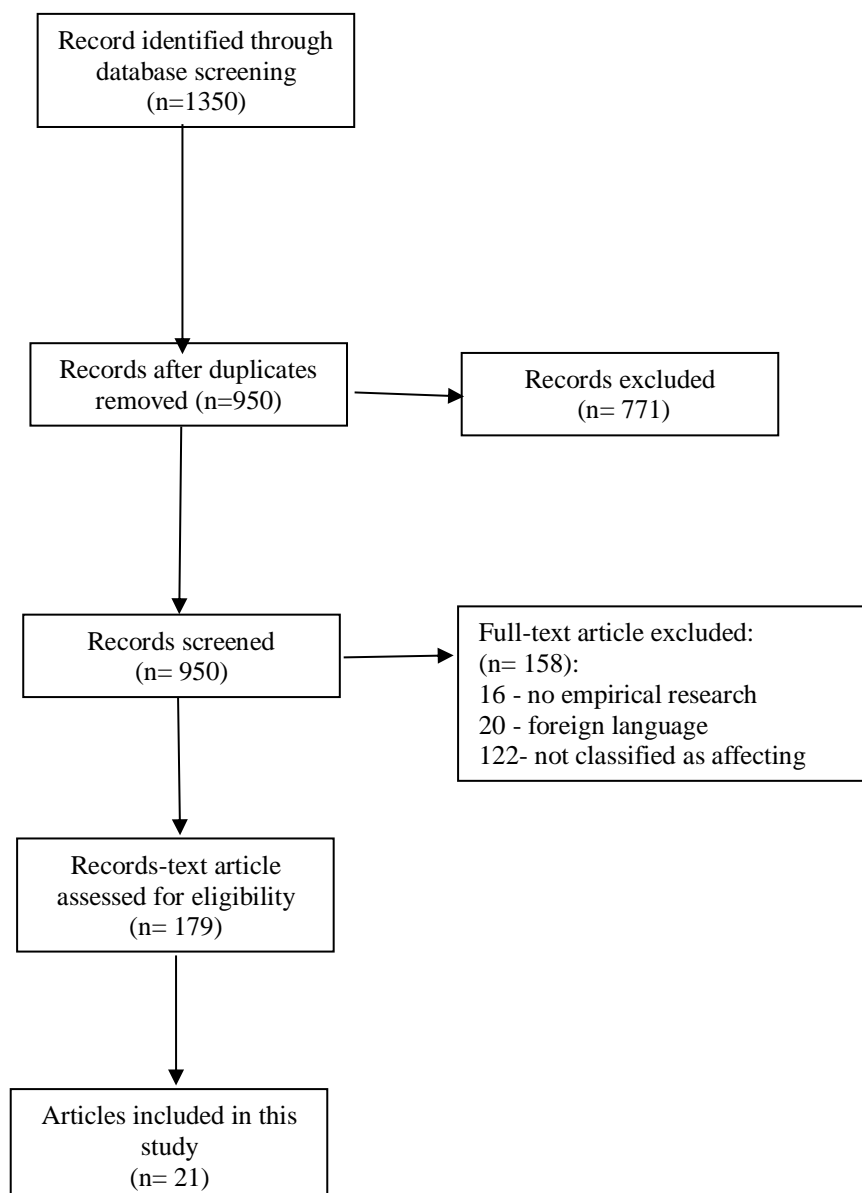


Figure 1 Article selection process

3. Results

The initial search identified 1350 references. After removing duplicates, 950 peer-reviewed articles remained for screening. Following the screening of titles and abstracts, 179 articles were eliminated for full-text review. Ultimately, 21 studies were included in the final review as indicated in Figure 1.

Summary of the studies included in the review:

A total of 21 studies were summarized and included in Table 1. The table consists of author(s), publication year, country, and key findings. The selected studies were from Malaysia (7), Vietnam (2), Singapore (2), Korea (2), Bangladesh (1), Laos (1), China (1), Sri Lanka (1), Indonesia (1), Thailand (1), Brunei (1), and Japan (1). From the final selection, all of the articles focused on fruit and vegetables. Among these studies, three (3) used the Social Cognitive Theory (SCT) by Bandura (1986).

4. Discussion

In previous studies in Malaysia, the Social Cognitive Theory (SCT) was used to assess the factors that influence and inhibit fruit and vegetable (FV) consumption among respondents. The results revealed that the variation in FV intake can be attributed to personal, behavioural, and environmental factors.

a. Personal Factors

Studies have shown that women are generally more likely than men to consume FV and to meet recommended guidelines. This may be because many women, even those with professional careers, still take on the traditional role of housewives, which includes purchasing food and preparing meals. Additionally, women with better cooking skills and greater access to information tend to consume more fruits and vegetables. Furthermore, women, typically the mothers in the family, often make decisions about home-cooked food for their families (Yen et al., 2012; Pengpid et al., 2019; Wan et al., 2016; Uraiwan et al., 2009; Md. Mazmul et al., 2010; Satheannopakao et al., 2009).

The intake of FV among adults is positively associated with age, income, and level of education. These findings are consistent with a study conducted in Malaysia and other Asian countries. This suggests that income differences may influence the eating patterns of adults, as individuals in lower household income groups tend to consume significantly fewer FV than those in higher income groups. This finding is expected, as lower-income individuals often prioritize spending on basic needs over purchasing fruits and vegetables. Additionally, educational level, knowledge, and understanding of the importance of fruits and vegetables play a significant role in motivating or acting as barriers to their intake (Sammeha et al., 2018; Khairunnisa Iszati et al., 2012; Nuru Izzah et al., 2012; Yen et al., 2012; Wan et al., 2016; Chong et al., 2017; Uraiwan et al., 2009; Bui et al., 2016; Md. Mazmul et al., 2010; Satheannopakao et al., 2009; Muriel, 2003; Choi et al., 2019).

The marital status and the number of people living in the same household were positively associated with FV intake. There were noticeable differences between married respondents and those who were single. Singles had a particularly higher risk of low FV intake compared to those who were married. This marital status may affect a person's FV intake through the partner's eating patterns, social support, and home availability of FV, especially when the partner is primarily responsible for grocery shopping, as is often the case for men (Khairunnisa Iszati et al., 2012; Yen et al., 2012; Satheannopakao et al., 2009).

The respondents consumed FV because they believed in the health benefits. They thought that consuming FV could help avoid or reduce symptoms of diseases such as diabetes, cancer, and high blood pressure. This is because fruits contain fiber and vitamins which aid in digestion, improve skin complexion, and reduce the risk of other diseases. However, the findings also showed that health problems were considered barriers to consuming FV (Sameeha et al., 2018; Norsyahidah et al., 2013; Pengpid et al., 2019; Wan et al., 2016; Chong et al., 2017; Bibi Nabihah et al., 2018; Herath, 2019; Muriel, 2003; Choi et al., 2019).

b. Environmental Factors

The cost of FV is the main factor that affects how much people eat. High prices can make it difficult for people to buy FV. Additionally, the influence of parents and family plays a significant role in motivating adults to consume FV. (Sameeha et al., 2018; Khairunnisa Iszati et al., 2012; Nurul Izzah 2012 et al., 2012; Yen et al., 2012; Pengpid et al., 2019; Chong et al., 2017; Uraiwan et al., 2009; Lim et al., 2017; Ling & Horwoth, 2001; Bui et al., 2016; Satheannopakao et al., 2009; Maisarah et al., 2016; Bibi Nabihah et al., 2018; Herath, 2019; Muriel, 2003; Choi et al.,).

Moreover, beliefs and culture are also considered as contributing factors to FV intake (Norsyahidah et al., 2013; Khairunnisa Iszati et al., 2012; Pengpid et al., 2019; Uraiwan et al., 2009). Research indicated that childhood experiences influence the consumption of FV intake. For instance, the availability of various types of FV in one's childhood environment, experiences with preparing FV, and pleasant memories of FV's taste all play a significant

role in FV intake.

The availability and easy access to FV had a significant impact on consumer behaviour. This was because adults who were responsible for purchasing FV tended to consume more. However, limited access and choices of FV in residential areas and workplaces were reported to negatively affect FV intake (Sameeha et al., 2018; Norsyahidah et al., 2013; Khairunnisa Iszati 2012; Nurul Izzah et al., 2012; Pengid et al., 2019; Lim et al., 2017; Bui et al., 2016; Herath, 2019; Abdul Hakim et al., 2012).

Sensory appeals are a source of pleasure and play an important role in a person's food choices. Research has shown that the types of FV chosen are based on individuals' taste preferences. Other attributes like texture, quality, smell, and appearance. However, some studies have revealed that sensory factors can also become a barrier (Norsyahidah et al. 2013; Nurul Izzah et al., 2012; Lim et al., 2017; Ling & Horwoth, 2001; Kim et al., 2014; Maisarah et al., 2016; Bibi Nabihah et al., 2018; Herath, 2019; Muriel, 2003).

It is important to remember that time constraints, preparation, and a busy lifestyle can make it difficult to consume FV. People have indentified lack of time as a barrier to eating more fruit, and the time and effort required to prepare vegetables as another barrier. Furthermore, spending most waking hours in the workplace leaves little time for social activities and even less time to go to the grocery store or market to get fresh FV. Therefore, it is important to consider convenience and ease of preparation when promoting FV intake (Yen et al., 2012; Chong et al., 2017; Maisarah et al., 2016; Muriel, 2003).

The media plays a crucial role in promoting healthy eating habits and influencing people's FV intake. Promotions through media channels can encourage financially capable individuals to buy and consume fruits and vegetables. The media can educate and motivate those who may have financial resource to grow their FV (Sameeha et al., 2018; Khairunnisa Iszati et al., 2012).

c. Behaviour Factors

The following factors - smoking habits, irregular diet, and binge drinking - hindered the intake of FV. Smokers reported feeling lethargic and having reduced appetite for FV due to their smoking habits. Additionally, many smokers believed that smoking was preferable to consuming FV. Furthermore, a majority of the respondents cited their busy schedules and lack of time as reasons for not having a regular diet (Sameeha et al., 2018; Yen et al., 2012; Wan et al., 2016; Md Mazmul et al., 2010).

The readiness to consume FV was a key factor that motivated individuals to eat more. However, FV requiring longer preparation time or a more complex preparation process pose a challenge to consumption (Maisarah et al. 2016; Muriel, 2003).

The next factor that influences FV intake is attitude, which has potential to both stimulate and impede consumption. Attitude encompasses overall evaluation, mood, feelings, and emotions, as well as an immediate response to certain stimuli. Respondents from various studies reported that their emotions influence their eating habits, which in turn affects their FV intake. For instance, people tend to choose unhealthy food when experiencing negative emotions [Khairunnisa Iszati et al., 2012; Nurul Izzah et al., 2012; Pengpid et al., 2019; Maisarah et al., 2016; Herath, 2019).

Furthermore, the participants mentioned that they ate to satisfy their hunger without paying much attention to the type of food they consumed. Furthermore, studies indicated that other obstacles to consuming FV were the frequency of eating out and previous experiences with weight loss (Sameeha et al., 2018; Ling & Horwoth, 2001; Bibi Nabihah et al., 2018).

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This study is registered under the National Medical Research Registry (NMRR-19-2659-50846) and the protocol has been approved by the Medical Research and Ethics Committee (MREC), Ministry of Health, Malaysia. The authors declare no conflict of interest.

6. Conclusion

Various factors such as cost, parental and family influences, taste preferences, attitude, habit, and availability. Research indicates that environmental factors have a greater impact on adults' intentions to eat FV than personal and behavioural factors. This scoping review aims to provide essential information about FV intake, particularly for policymakers and researchers. Additionally, it seeks to enhance the documentation on the facilitators and barriers to fruit and vegetable intake behaviour among adults.

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Appendix

Table 1. Articles Included

No.	Authors (year)	Country	Key Findings	
			Facilitating	Barriers
1.	Sameeha et al. (2018)	Malaysia	Personal Factors: <ul style="list-style-type: none"> • Knowledge • Awareness • Income • Age • Health problems Environmental Factors: <ul style="list-style-type: none"> • Social Influences • Media Influences • Availability • Accessibility • Costs Behavioural Factors: <ul style="list-style-type: none"> • Eating habits 	Personal Factors: <ul style="list-style-type: none"> • Income • Age • Health problems Environmental Factors: <ul style="list-style-type: none"> • Social Influences • Media Influences • Availability • Accessibility • Costs Behavioural factors: <ul style="list-style-type: none"> • Eating habits • Smoking habits
2.	Norsyahidah et al. (2013)	Malaysia	Personal Factors <ul style="list-style-type: none"> • Health consciousness • Knowledge Environmental Factors <ul style="list-style-type: none"> • Parental control • Quality • Availability Behavioural Factors <ul style="list-style-type: none"> • Taste and preference 	Personal Factors <ul style="list-style-type: none"> • Childhood experience • Ethnic belief and tradition Environmental Factors: <ul style="list-style-type: none"> • Quality • Freshness • Availability Behavioural Factors <ul style="list-style-type: none"> • Taste • Parents eating patterns
3.	Khairulnissa Iszati et al. (2012)	Malaysia	Personal Factors <ul style="list-style-type: none"> • Age • Marital Status • Ethnicity • Educational Level • Household Income Environmental Factors	Personal Factors <ul style="list-style-type: none"> • Low income • Single

			<ul style="list-style-type: none"> • Social Influences • Availability <p>Behavioural Factors</p> <ul style="list-style-type: none"> • Attitude • Habit • Intention to consume 	<p>Environmental Factors</p> <ul style="list-style-type: none"> • Social Cultural
4.	Nurul Izzah et al. 2012	Malaysia	<p>Personal Factor</p> <ul style="list-style-type: none"> • Taste and preference <p>Environmental Factors</p> <ul style="list-style-type: none"> • Availability • Affordability 	<p>Personal Factors</p> <ul style="list-style-type: none"> • Low Educational Level of nutritional practice • Low Income • Lack of awareness on Nutrition <p>Environmental Factors</p> <ul style="list-style-type: none"> • Less accessibility • Availability
5.	Yen ST, Tan AK & Feisul et al. 2012	Malaysia	<p>Personal Factors</p> <ul style="list-style-type: none"> • Age • Ethnicity • Higher education level • High income • Gender <p>Behaviour Factors</p> <ul style="list-style-type: none"> • Smoking status <p>Environmental Factor</p> <ul style="list-style-type: none"> • Location 	<p>Personal Factors</p> <ul style="list-style-type: none"> • Age • Less Educated • Gender • Marital status • People with diabetes incline to eat fruits <p>Behavioural Factor</p> <ul style="list-style-type: none"> • Smokers <p>Environmental Factors</p> <ul style="list-style-type: none"> • Location • Longer working hours
6.	Wang DH et al. 2016	Japan	<p>Personal Factors</p> <ul style="list-style-type: none"> • Gender • Nutritional Knowledge <p>Behavioural Factors</p> <ul style="list-style-type: none"> • Attitude • Self-efficacy 	<p>Environmental Factors</p> <ul style="list-style-type: none"> • Cost • Family and self-preference • Availability <p>Behavioural Factors</p> <ul style="list-style-type: none"> • Lack of awareness • Personal Habits • Personal judgement
7.	Pengpid, S. 2019	Laos	<p>Personal Factors</p> <ul style="list-style-type: none"> • Higher Education 	<p>Personal Factors</p> <ul style="list-style-type: none"> • Lower education

			<ul style="list-style-type: none"> • BMI (high) • Urban 	Behavioural Factors <ul style="list-style-type: none"> • Obesity • Tobacco use • Binge drinking
8.	Chong LY et al.2017	China	Personal Factor <ul style="list-style-type: none"> • Higher Educational level Environmental Factor <ul style="list-style-type: none"> • Urban area 	Personal Factors <ul style="list-style-type: none"> • Low socio-economic status • Elderly • Low educational level • Single Environmental Factor <ul style="list-style-type: none"> • Rural area Behavioural Factors <ul style="list-style-type: none"> • Low Health Literacy • Irregular breakfast or lunch • Underweight • Habits • No leisure-physical activity
9.	Uraiwan K et al.2009	ASIAN (Bangladesh, India, Indonesia, Thailand & Vietnam)		Personal Factors <ul style="list-style-type: none"> • Gender- Female • Older (55-64 years old) • Less educated • Low income • Cost Environmental Factors <ul style="list-style-type: none"> • Different psychosocial and cultural
10.	Lim, RBT et al. 2017	Singapore	Environmental Factors <ul style="list-style-type: none"> • Price • Seasonal availability • Accessibility • Preference 	Environmental Factor <ul style="list-style-type: none"> • Price
11.	Ling AMC & Horwath C. 2001	Singapore	Personal Factors <ul style="list-style-type: none"> • Taste • Price • Convenience 	Personal Factors <ul style="list-style-type: none"> • Taste • Price • Convenience
12.	Bui TV et al 2016	Vietnam	Personal Factors <ul style="list-style-type: none"> • Level of education 	Environmental Factor <ul style="list-style-type: none"> • Limited availability

			<ul style="list-style-type: none"> Household income 	Behavioural Factors <ul style="list-style-type: none"> Lack of knowledge Lack of understanding
13.	Kim, Ban & Mayers 2014	Korea	Personal Factor <ul style="list-style-type: none"> Household income Environmental Factors <ul style="list-style-type: none"> Freshness Price Sweetness 	Not reported
14.	Md. Mazmul Karim et al. 2010	Bangladesh	Personal Factors <ul style="list-style-type: none"> Higher educational Female Behavioural Factor <ul style="list-style-type: none"> Smokeless tobacco 	Personal Factor <ul style="list-style-type: none"> Elderly Low educational level Environmental Factor <ul style="list-style-type: none"> Poor quality
15.	Satheannopakao, W et al. 2009	Thailand	Personal Factor <ul style="list-style-type: none"> Women Higher educational level Higher income Single Environmental Factor <ul style="list-style-type: none"> Urban 	Personal Factor <ul style="list-style-type: none"> Elderly Married Lower educational level Lower income Environmental factor <ul style="list-style-type: none"> Price
16.	Maisarah Sharif et al 2016	Brunei	Behavioural Factor <ul style="list-style-type: none"> Fruits – as snacking Vegetables-preferred during lunch and dinner 	Environmental Factors <ul style="list-style-type: none"> Household choice Time Skills Quality
17	Bibi Nabihah et al 2018	Malaysia	Environmental Factors <ul style="list-style-type: none"> Sensory appeal Health benefit Healthy bowel movement Less preparation effort Availability Influence of family Cost 	Environmental Factors <ul style="list-style-type: none"> Cost Limited choice available Storage problems Eating outside Sensory appeals (taste) Not commonly consumed by family

				<p>Personal Factor</p> <ul style="list-style-type: none"> • Bloating • Feeling cold
18	Hearth US 2019	Sri Lanka	<p>Personal Factor</p> <ul style="list-style-type: none"> • Nutritional Value <p>Environmental Factors</p> <ul style="list-style-type: none"> • Availability • Price • Taste <p>Behavioural Factor</p> <ul style="list-style-type: none"> • Habit 	<p>Personal factors</p> <ul style="list-style-type: none"> • Pesticide residue on vegetables • Health issue <p>Environmental Factors</p> <ul style="list-style-type: none"> • Unavailability in the market • High price
19	Muriel Figuiere-CIRAD	Vietnam	<p>Personal Factors</p> <ul style="list-style-type: none"> • Household income • Health Benefits <p>Environmental Factors</p> <ul style="list-style-type: none"> • Cheaper • Beautiful appearance • Freshness • Taste • Tenderness • Fruit size 	<p>Personal Factor</p> <ul style="list-style-type: none"> • Using pesticides/agrochemical <p>Environmental Factors</p> <ul style="list-style-type: none"> • Living places • Food preparation
20	Abdul Hakim et al. 2012	Malaysia		<p>Environmental Factors</p> <ul style="list-style-type: none"> • Living at the college • Availability of fast-food restaurant • Lack of time • Unavailability of FV at University Shop itself
21	Choi et al. 2019	Korea	<p>Personal Factors</p> <ul style="list-style-type: none"> • Higher Educational Level • Higher income • Older age 	<p>Personal Factor</p> <ul style="list-style-type: none"> • Obesity