



E-commerce food choice in the west: comparing business-to-consumer, online-to-offline food delivery service, and click and collect

Ou Wang¹ · Federico J. A. Perez-Cueto² · Frank Scrimgeour¹

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Abstract

This study aims to explore the significant factors driving food consumption through three e-commerce modes: Business-to-Consumer, Online-to-Offline Food Delivery Service, and Click & Collect in developed Western countries. A total of 1,461 samples were collected through online surveys in New Zealand, the United Kingdom, and Denmark. Descriptive analysis and ordered logistic regression were employed for data analyses. Overall, consumers' food consumption frequencies with e-commerce were found to be significantly influenced by several socio-demographics, e-commerce food choice motives, innovation-adoption characteristics and e-service quality attributes.

Keywords New Zealand · Denmark · United Kingdom · E-commerce · B2C · O2O · Click and collect · COVID-19

1 Introduction

The era of food shopping via e-commerce began at least a decade ago, but it has recently gathered momentum globally [1–4]. The e-commerce food shopping first exploded in Asia (e.g. China) due to the huge population base, cheap logistic cost, and cheap mobile devices and services in the region [5]. This is in line with the large number of published empirical studies on consumers' e-commerce food shopping, which were conducted using consumer samples in Asian developing countries [6–16]. In general, scholars have confirmed the following factors significantly impacted on consumer adoption of e-commerce food shopping, including

✉ Ou Wang
ou.wang@waikato.ac.nz

¹ School of Accounting, Finance and Economics, Waikato Management School, University of Waikato, Hamilton, New Zealand

² Department of Food, Nutrition and Culinary Science, Umeå University, Lärarutbildningshuset, Umeå, Sweden

innovation-adoption characteristics (IACs), e-commerce food choice motives (EFCMs), e-service quality, and socio-demographics [6–16]. However, these findings are scattered and primarily focus on a single e-commerce food shopping mode, mainly Business-to-Consumer (B2C) or Online-to-Offline Food Delivery Service (O2O-FDS). There is a lack of systematic understanding of the significant factors influencing consumer adoption of e-commerce food shopping by employing a comprehensive model that encompasses all the significant factors mentioned above, as well as the studies exploring the influences of these important factors on e-commerce food shopping modes of non-B2C and O2O-FDS, such as Click & Collect (C&C). Additionally, there is a shortage of studies that compare consumer behavior across various e-commerce food shopping modes. To the best of our knowledge, we have found only one study that compares consumer behaviors across multiple e-commerce food shopping modes: B2C, O2O-FDS, Online-to-Offline In-store (O2O-IS), and New Retail [3]. The findings from this study indicate that several important factors have significantly different influences on consumer adoption of food shopping in these four e-commerce modes [3].

Western developed countries had a relatively delayed market development of e-commerce food shopping compared to their Asian developing counterparts. This is caused by the different food consumption systems between Western developed and Asian developing countries. Western developed countries have a low population base resulting in high labor and logistic costs, a high vehicle ownership ratio, and offline giant food retailers with mature systems for logistics, goods delivery, and post-sales service, compared to Asian developing countries [17]. This reality is a significant obstacle for the development of e-commerce food shopping in Western developed countries. However, Western developed countries have recently experienced rapid growth in the market shares of e-commerce food shopping [18–20]. In contrast to the abundance of Asian-sample-based academic research, only a few empirical studies have been conducted in the field of e-commerce food shopping using consumer samples from developed Western countries, most of which were published in the past three years [7, 19, 21, 22]. There is a lack of empirical studies systematically exploring the influences of the important factors regarding e-commerce food shopping mentioned above, which were recognized by previous consumer studies mainly based on Asian samples, on Western consumers [6–16]. Additionally, the Western-sample-based studies have only explored consumer adoption of a single e-commerce food shopping mode, with most of them focusing on O2O-FDS [3, 23–25]. There is a lack of understanding of Western consumer behaviors toward other important e-commerce food shopping modes.

To address the knowledge gaps outlined above, this study explores the significant factors driving consumer adoption of three e-commerce food shopping modes: B2C, O2O-FDS, and C&C in three developed Western countries: Denmark, New Zealand (NZ), and the United Kingdom (UK). The study associates Western consumers' e-commerce food shopping frequencies with various influential factors, including socio-demographics, EFCMs, and the perceived importance of IACs and e-service quality attributes. Furthermore, the study will compare the factorial influences on e-commerce food shopping frequencies across the three e-commerce modes- B2C, O2O-FDS and C&C. The purpose of this research is to systematically identify the

significant factors influencing Western consumers' purchase decisions for food using different e-commerce modes.

2 Theoretical background and hypotheses

2.1 E-commerce food shopping modes

There are five common e-commerce food shopping modes: B2C, O2O-FDS, O2O-IS, C&C, and New Retail [3, 23–25]. B2C is the oldest e-commerce food shopping mode [23, 26]. In this mode, consumers purchase food products that are delivered to them from online sellers which have no physical shops in their local regions, by using B2C mobile applications (APPS)/online platforms (e.g. Amazon) [3, 26]. Online-to-offline (O2O) is an e-commerce food shopping mode, whereby consumers can order food or a meal service online from their local food retailers and restaurants by using O2O mobile APPS/online platforms (developed by third-party service providers such as Uber Eats, Zomato, Yelp, and TripAdvisor, or by local physical restaurants and retailers, such as Dominos, McDonalds, and local supermarkets) [3, 19, 27]. There are three sub-modes of O2O e-commerce food shopping including O2O-FDS, O2O-IS, and C&C. These sub-O2O modes are different in terms of consumers' final consumption approaches to the food products/meals ordered from the O2O APPS/ online platforms. Regarding O2O-FDS, the food/meal is delivered to consumers [3, 19]. When using O2O-IS, consumers have to physically eat the food/meal at the local restaurants/food retailers [28, 29]. For C&C, consumers have to physically collect the food/meal at the local restaurants/food retailers [25, 30]. New Retail is an innovative e-commerce mode which digitalises traditional food retail stores with technologies such as big data, cloud computing, the Internet of Things and artificial intelligence, and provides 'three-in-one' service including delivery to home, in-store purchase, and in-store dining [3, 24, 31–37]. Currently, New Retail stores are only located in the big cities of China and the USA, such as Hema Fresh in Shanghai and Beijing, and Amazon Go in New York and Seattle [31, 35].

Due to strictly limited eating out, O2O-IS has not been a safe food consumption mode for consumers during the COVID-19 epidemic [1, 28, 29]. New Retail stores can provide better support for contactless food shopping than traditional food retailers [31, 35]. However, New Retail Stores are only available in limited cities in China and the USA [3, 31, 35]. Since the data of this study was collected in the UK, NZ and Denmark during the COVID-19 epidemic, these two e-commerce food shopping modes were excluded from the study.

2.2 E-service quality

The service quality of e-commerce food shopping platforms/apps has significant and direct impacts on consumers' purchase and repurchase of food on them [5]. E-service quality has four dimensions: visual menu appeal (degree of the effective APP/platform design and picture arrangement to attract consumers' attention

to the food and restaurants on it); menu informativeness (degree of effective APP/platform design to show consumers' expected information about food, sellers and services, accurately, adequately, and in a timely fashion); trustworthiness (degree of consumers' trust in relation to the e-commerce food shopping APP/platform and the sellers on it); customer-service quality (degree of consumers' satisfaction with the customer services provided by the e-commerce food shopping APP/platform, such as timely customer support and sending out the product) [5, 9, 11]. Consumers' satisfaction with e-service quality has proven to be an important driving factor for their e-commerce food shopping [9, 11, 15]. Therefore, the following hypotheses have been formulated:

- H1a.** Consumers' perceived importance of e-service quality has significant influence on their B2C food shopping frequencies.
- H1b.** Consumers' perceived importance of e-service quality has significant influence on their O2O-FDS food shopping frequencies.
- H1c.** Consumers' perceived importance of e-service quality has significant influence on their C&C food shopping frequencies.

2.3 Innovation-adoption characteristics

IACs refer to factors that influence consumers' adoption of innovative products and services [5, 26, 38, 39]. In general, there are five IACs influencing consumer adoption of e-commerce food shopping behavior including social norms (degree of perceived peer pressure on personal adoption of e-commerce food shopping), perceived compatibility (degree of perceived fitness of e-commerce food shopping with personal lifestyle and values), perceived complexity (degree of perceived complexity of using e-commerce food shopping platforms/APPs), the perceived risk (degree of perceived risks related to e-commerce food shopping, such as privacy disclosure) and the perceived relative advantage (degree of perceived superiority of e-commerce food shopping over traditional offline food shopping, such as time and money saving) [19, 26, 39]. The five IACs have been found to have significantly positive or negative impacts on consumer adoption of e-commerce food shopping [8, 10, 12, 15, 19, 26]. Therefore, the following hypotheses have been formulated:

- H2a.** Consumers' perceived importance of IACs have significant influence on their B2C food shopping frequencies.
- H2b.** Consumers' perceived importance of IACs have significant influence on their O2O-FDS food shopping frequencies.
- H2c.** Consumers' perceived importance of IACs have significant influence on their C&C food shopping frequencies.

2.4 E-commerce food choice motives

Food choice motives refer to people's daily motives for food choice [40, 41]. Previous studies have identified EFCMs which are food choice motives related to e-commerce food shopping, including value for money, sensory appeal, affordability

(cheapness), variety, safety concerns, quality concerns, mood (hedonic motivation), processed convenience, purchase convenience, others' reviews and discount [3, 15, 16, 19, 42, 44]. Some of these EFCMs are strongly linked to consumers' perception of relative advantages for e-commerce food shopping in the theory of IACs such as convenience (superiority in terms of time saving over traditional offline food shopping). Further, during the COVID-19 epidemic, scholars have identified two other motives that may significantly impact consumers' engagement in e-commerce food shopping: contactless delivery/collection (using e-commerce for avoiding physical contact with others) and unavailable offline (utilizing e-commerce for items not found in local stores) [8, 11, 45–50]. In addition, several EFCMs are found to significantly influence consumers' adoption of e-commerce food shopping including mood, variety, quality concern, discount, processed convenience, purchase convenience, safety concern, and sensory appeal [3, 5, 9, 11, 19]. Therefore, the following hypotheses have been formulated:

H3a. Consumers' EFCMs have significant influence on their B2C food shopping frequencies.

H3b. Consumers' EFCMs have significant influence on their O2O-FDS food shopping frequencies.

H3c. Consumers' EFCMs have significant influence on their C&C food shopping frequencies.

2.5 Socio-demographics

Consumers' socio-demographics have significant impacts on their adoption of e-commerce food shopping. The following socio-demographics are found to have significant impacts on consumers' behavior, behavioral intention, and segmentation with regard to e-commerce food shopping: gender, age, income, occupation, household size, marital status, education, and residential location [3, 5, 12, 13, 19, 26, 51–54]. Therefore, the following hypotheses have been formulated:

H4a. Consumers' socio-demographics have significant influence on their B2C food shopping frequencies.

H4b. Consumers' socio-demographics have significant influence on their O2O-FDS food shopping frequencies.

H4c. Consumers' socio-demographics have significant influence on their C&C food shopping frequencies.

3 Methods and materials

3.1 Participants

Quantitative consumer data were collected from July to August 2021 by using online surveys in the largest cities of NZ, the UK, and Denmark: Auckland, London, and Copenhagen. A questionnaire was developed in English and translated into

Danish by a professional translator. An internationally reputable research agency was employed for the online questionnaire distribution within its representative sample panels for the three countries. A soft launch was conducted in the three cities ($n=50$ each). The questionnaire was not further revised due to the acceptable scale reliabilities of the soft launch datasets produced. The soft-launch datasets were later combined within the final datasets of this study. A total of 1,461 valid samples were collected, 497 from Auckland, 493 from London, and 471 from Copenhagen. All valid respondents received a monetary incentive from the research agency. Table 1 shows the socio-demographic characteristics of the samples including age, gender, marital status, education, occupation, household size, and residential location (rural/urban).

Table 1 also indicates respondents' financial situations before and during the COVID-19 epidemic. The financial situations were subjectively evaluated by respondents, with two measurement items—'I feel that my financial situation before the COVID-19 epidemic used to be:' and 'I feel that my financial situation during the COVID-19 epidemic has been:' on a 7-point interval scale, where 1 meant 'difficult' and 7 meant 'well off'.

3.2 Measures and procedures

Participants were first shown the socio-demographic questions, and then the questions related to e-commerce food shopping. Prior to the e-commerce food shopping questions, they were asked to read a description about the three e-commerce food shopping modes B2C, O2O-FDS, and C&C, with examples of the e-commerce food shopping platforms specifically run in the three countries.

Participants were asked to provide their overall consumption frequencies of food shopping with B2C, O2O-FDS, and C&C in the year before and during the COVID-19 epidemic on an 11-point ordinal scale—11: 7 times or more frequent each week, 10: 5–6 times each week, 9: 3–4 times each week, 8: 1–2 times each week, 7: 2–3 times each month, 6: once each month, 5: 9–11 times a year, 4: 6–8 times a year, 3: 3–5 times a year, 2: 1–2 times a year, and 1: never. The measurement design was developed from previous studies which explored food consumption frequencies [50, 55]. These consumption frequency variables were later recoded into an ordinal variable with three categories—1: never, 2: once each month or less, and 3: twice each month or more, due to the low response number of participants in some of the original response categories.

Participants were asked to evaluate the importance of 21 factors related to e-commerce food shopping shown in Table 2. The 21 measurement items were developed from previous studies which explored consumers' perceived e-service quality [9, 11, 15], IACs [19, 26], and EFCMs [3, 19, 40]. Participants were asked to self-evaluate the importance of the 21 factors on their e-commerce food shopping in general on a 7-point Likert agreement scale, where 1 meant 'totally disagree' and 7 meant 'totally agree'. The measurement design was developed from previous studies that explored consumers' perceived importance of product attributes and EFCMs on food products/services [3, 19, 40, 55].

Table 1 Socio-demographic distribution of the sample

	Total sample	Auckland	London	Copenhagen
Sample size (n=)	1461	497	493	471
<i>Gender</i>				
Male	51.0%	45.7%	48.9%	58.8%
Female	49.0%	54.3%	51.1%	41.2%
<i>Marital status</i>				
Married	48.5%	53.7%	43.6%	48.0%
No, but has a partner	19.4%	20.1%	15.8%	22.3%
Single	32.2%	26.2%	40.6%	29.7%
<i>Age</i>				
Range	18–85	18–85	18–80	18–79
Mean	43.1	45.04	44.89	39.19
<i>Education</i>				
Secondary school (ISCED Level 2–3) or below	13.6%	16.7%	17.6%	5.9%
Post-secondary non-tertiary education (ISCED Level 4)	10.8%	7.8%	11.6%	13.2%
Short-cycle tertiary education (ISCED Level 5)	19.3%	16.3%	10.8%	31.4%
Bachelor or equivalent (ISCED Level 6)	38.7%	41.4%	40.2%	34.2%
Master, equivalent (ISCED Level 7) or above	17.7%	17.7%	19.9%	15.3%
<i>Occupation</i>				
Self-employed	10.3%	12.1%	9.5%	9.3%
Managing employee	10.1%	5.0%	13.2%	12.3%
Salaried employee	46.3%	47.7%	40.8%	50.5%
Worker	7.0%	8.7%	6.5%	5.7%
Student	5.5%	4.6%	4.5%	7.6%
Unemployed, Retired, Housewife/houseman or on leave	18.2%	19.5%	22.5%	12.3%
Other (including farmer)	2.5%	2.4%	3.0%	2.1%

Table 1 (continued)

	Total sample	Auckland	London	Copenhagen
<i>Household size</i>				
Range	1–8	1–8	1–8	1–8
Mean	2.81	2.96	2.81	2.64
<i>Residential place</i>				
Completely isolated home in a rural area	1.7%	1.6%	1.2%	2.3%
Home in a small rural village	3.8%	3.0%	2.2%	6.4%
Home in a mid-sized rural village	5.1%	1.4%	1.8%	12.5%
Small town in mostly rural surroundings	9.2%	5.6%	6.9%	15.3%
Large town in mostly urban surroundings	23.4%	18.5%	24.1%	27.8%
In large urban area within 10 min walk from some green space	46.5%	62.8%	49.9%	25.9%
In large urban area more than 10 min walk away from any green space	10.2%	7.0%	13.8%	9.8%
Financial situation before the COVID-19 epidemic (mean)	4.77	4.74	4.64	4.94
Financial situation during the COVID-19 epidemic (mean)	4.20	4.09	4.07	4.46

Table 2 Measurement items of perceived importance of factors influencing e-commerce food shopping

Factor	Measurement item
(It is important to me that the food product/meal kit/meal I purchased or purchasing food product/meal kit/meal by using e-commerce platforms/mobile apps...)	
<i>E-service quality</i>	
Menu visual appeal	Looks attractive from the pictures and menus shown on the platforms/mobile apps
Menu informativeness	Is well informed on the platforms/mobile apps (e.g. the information provided by the platforms/mobile apps is accurate, reliable, understandable and clear)
Trustworthiness	Is from trustworthy platforms/mobile apps and retailers and restaurants
Customer-service quality	Has a good customer service
<i>Innovation-adoption characteristics</i>	
Perceived risk	Protects my personal information and privacy
Perceived compatibility	Fits well with my lifestyle
Perceived ease	Is easy to handle by myself
Social norm	Is recommended and supported by my family members or friends
<i>E-commerce food choice motives</i>	
Unavailable offline	Is unavailable or out of stock offline
Contactless delivery/collection	Is non-contact in delivery or collection
Value for money	Is good value for money
Discount	Has a discount or e-coupon
Variety	Has a wide variety to choose from the platforms/mobile apps
Safety concern	Is safe (e.g. clean, hygienic, with reliable ingredients)
Quality concern	Is high quality
Others' reviews	Has good evaluations from other buyers shown on the platforms/mobile apps
Sensory appeal	Provides me with pleasurable sensations (e.g. texture, appearance, smell and taste)
Affordability	is affordable
Mood	Is a way of monitoring my mood (e.g. a good feeling or coping with stress)
Purchase convenience	Is convenient when buying (e.g. time-saving to purchase)
Processed convenience	Is convenient when cooking (e.g. time-saving to cook)

3.3 Data analysis

Data were analysed utilizing the statistical software tools, Stata 17 and SPSS 29. Descriptive analyses were conducted to identify differences in consumers' food consumption with B2C, O2O-FDS, and C&C among consumers in both total sample and the sub-samples of NZ, the UK, and Denmark.

The current study developed ordered logistic regression models due to the dependent variables as ordered responses—the food consumption frequencies in different e-commerce food shopping situations (e.g. B2C, O2O-FDS, or C&C, before

or during the COVID-19 epidemic) [13, 55]. The ordered logistic regression model is a common approach in solving discrete choice problems [13, 55]. The general ordered logistic regression model can be summarised as follows:

$$y_{ij}^* = \sum_{k=1}^K \beta_{kj} x_{ik} + \varepsilon_{ij} \quad (1)$$

where x_{ik} is a vector of k independent variables explaining the consumption frequency of e-commerce food shopping by *participant_i*. β_{kj} denotes a vector of corresponding coefficients for the k independent variables, and ε_{ij} represents the unobserved error term, for *participant_i* and in an *e-commerce food shopping situation_j*, that is based on two situational factors: the e-commerce food shopping mode (B2C, O2O-FDS, or C&C), and the period regarding the COVID-19 epidemic (before or during). In total, there are six e-commerce food shopping situations in this study.

Then the observed dependent variable y_{ij} can be defined as:

$$y_{ij} = m, \quad \text{if } \theta_m < y_{ij}^* \leq \theta_{m+1} \quad (2)$$

where $\theta_1, \theta_2, \dots, \theta_h$ are cut points and will be estimated.

The observed dependent variable y_{ij} represents *participant_i*'s consumption frequency with the *e-commerce food shopping situation_j*. The six e-commerce food shopping situations result in six dependent variables- $y_{i1}, y_{i2}, \dots, y_{i6}$. There are three categories for the consumption frequency of e-commerce food shopping in this study: 1=never, 2=once each month or less, and 3=twice each month or more. In this case, the consumption frequency of e-commerce food shopping y_{ij} can be defined as:

$$y_{ij} = \begin{cases} 1 & \text{if } y_{ij}^* \leq \theta_1 \\ 2 & \text{if } \theta_1 < y_{ij}^* \leq \theta_2 \\ 3 & \text{if } \theta_2 < y_{ij}^* \leq \theta_3 \end{cases} \quad (3)$$

If we set $y_{ij}^* = \sum_{k=1}^K \beta_{kj} x_{ik} + \varepsilon_{ij} = W_{ij} + \varepsilon_{ij}$, the probability set of the observed consumption frequency with *e-commerce food shopping situation_j* for *participant_i* can be estimated by using the equations below:

$$\begin{aligned} \text{Prob}(y_{ij} = 1) &= \text{Prob}(W_{ij} + \varepsilon_{ij} \leq \theta_1) = \text{Prob}(\varepsilon_{ij} \leq \theta_1 - W_{ij}) \\ \text{Prob}(y_{ij} = 2) &= \text{Prob}(\theta_1 < W_{ij} + \varepsilon_{ij} \leq \theta_2) = \text{Prob}(\theta_1 - W_{ij} < \varepsilon_{ij} \leq \theta_2 - W_{ij}) \\ \text{Prob}(y_{ij} = 3) &= \text{Prob}(\theta_2 < W_{ij} + \varepsilon_{ij} \leq \theta_3) = \text{Prob}(\theta_2 - W_{ij} < \varepsilon_{ij} \leq \theta_3 - W_{ij}) \end{aligned} \quad (4)$$

The purpose of the regression models is to estimate the probability of each consumption frequency category of e-commerce food shopping by using the given predictors. Regression parameters are estimated by using the likelihood ratio method to calculate a set of regressions until the best solutions are obtained [13, 55]. The results are commonly reported as odds ratios with 95% confidence intervals for an

ordered logistic regression model; in which an odds ratio higher than 1 represents a positive effect of the independent variable on the dependent variable, and where lower than 1 represents a negative effect of the independent variable on the dependent variable [13, 55].

In general, six ordered logistic regression models were developed in this study based on the six dependent variables. The description of the different variables used in the regression models is presented in Table 3. Independent variables include participants' socio-demographics, and the perceived importance of factors regarding EFCMs, IACs and e-service quality. Additionally, the categorical socio-demographic variables—occupation, marital status and country—are dummy coded for the regression analyses [56]. The following dummy variables are therefore included in the regression models: occupation 1 (self-employed), occupation 2 (managing employee), occupation 3 (salaried employee), occupation 4 (worker), occupation 5 (student), occupation 6 (unemployed, retired, housewife/houseman or on leave), marital status 1 (married), marital status 2 (single), city 1 (Auckland) and city 2 (London).

4 Results and discussion

4.1 Frequencies of e-commerce food shopping

Table 4 specifically indicates the food consumption frequencies of B2C, O2O-FDS and C&C in total sample and the sub-samples in Auckland, London, and Copenhagen. Chi-square tests for contingency tables indicated the significant differences of food consumption with all the three e-commerce modes before and during the COVID-19 epidemic in total sample. The food consumption frequencies of B2C, O2O-FDS and C&C during the COVID-19 epidemic were higher than those before the epidemic (e.g. with smaller percentages of participants who never shopped for food with B2C, O2O-FDS and C&C during the COVID-19 epidemic, and higher percentages of participants who shopped for food with the three e-commerce modes twice each month or more than that before the COVID-19 epidemic). As such, consumers are more willing to purchase food/meals with all three e-commerce modes—B2C, O2O-FDS and C&C—during the COVID-19 epidemic than before the epidemic. This is in accordance with findings from recent published studies that the COVID-19 epidemic accelerated adoption of e-commerce food shopping globally [1–3].

Chi-square tests revealed the significant differences of e-commerce food shopping among the three countries. Danish participants had the highest food consumption frequencies for all three e-commerce modes among the participants of the three countries (e.g. with smaller percentages of participants who never shopped for food using the three e-commerce modes, and a higher percentage of participants who shopped for food with the three e-commerce modes twice each month or more than their counterparts in NZ and the UK). By contrast, NZ participants experienced the

Table 3 Variable description for ordered logistic regressions in the study

Variable	Type	Description
<i>Dependent variable</i>		
B2C consumption before the COVID-19 epidemic (Model 1)		
B2C consumption during the COVID-19 epidemic (Model 2)		
O2O-FDS consumption before the COVID-19 epidemic (Model 3)	Ordered (1–3)	Never (=1) Once each month or less (=2) Twice each month or more (=3)
O2O-FDS consumption during the COVID-19 epidemic (Model 4)		
C&C consumption before the COVID-19 epidemic (Model 5)		
C&C consumption during the COVID-19 epidemic (Model 6)		
<i>Independent variables</i>		
Menu visual appeal	Continuous	Range (1–7)
Menu informativeness	Continuous	Range (1–7)
Trustworthiness	Continuous	Range (1–7)
Customer-service quality	Continuous	Range (1–7)
Perceived risk	Continuous	Range (1–7)
Perceived compatibility	Continuous	Range (1–7)
Perceived ease	Continuous	Range (1–7)
Social norm	Continuous	Range (1–7)
Unavailable offline	Continuous	Range (1–7)
Contactless delivery/collection	Continuous	Range (1–7)
Value for money	Continuous	Range (1–7)
Discount	Continuous	Range (1–7)
Variety	Continuous	Range (1–7)
Safety concern	Continuous	Range (1–7)
Quality concern	Continuous	Range (1–7)
Others' reviews	Continuous	Range (1–7)
Sensory appeal	Continuous	Range (1–7)
Affordability	Continuous	Range (1–7)

Table 3 (continued)

Variable	Type	Description
Mood	Continuous	Range (1–7)
Purchase convenience	Continuous	Range (1–7)
Processed convenience	Continuous	Range (1–7)
Financial situation before the COVID-19 epidemic	Continuous	Range (1–7)
Financial situation during the COVID-19 epidemic	Continuous	Range (1–7)
City (Auckland)	Binary (0,1)	No (=0), Yes (=1)
City (London)	Binary (0,1)	No (=0), Yes (=1)
Gender (male)	Binary (0,1)	Female (=0), Male (=1)
Age	Continuous	Range (18–85)
Household size	Continuous	Range (1–8)
<i>Independent variables</i>		
Marital status (married)	Binary (0,1)	No (=0), Yes (=1)
Marital status (single)	Binary (0,1)	No (=0), Yes (=1)
Occupation (self-employed)	Binary (0,1)	No (=0), Yes (=1)
Occupation (managing employee)	Binary (0,1)	No (=0), Yes (=1)
Occupation (salaried employee)	Binary (0,1)	No (=0), Yes (=1)
Occupation (worker)	Binary (0,1)	No (=0), Yes (=1)
Occupation (student)	Binary (0,1)	No (=0), Yes (=1)
Occupation (unemployed, retired, housewife/houseman or on leave)	Binary (0,1)	No (=0), Yes (=1)
Education	Ordered (1–5)	Secondary school or below (=1), Post-secondary non-tertiary education (=2), Short-cycle tertiary education (=3), Bachelor or equivalent (=4), Master, equivalent or above (=5)

Table 3 (continued)

Variable	Type	Description
Residential place (rural/urban)	Ordered (1–7)	Completely isolated home in a rural area (=1), Home in a small rural village (=2), Home in a mid-sized rural village (=3), Small town in mostly rural surroundings (=4), Large town in mostly urban surroundings (=5), In large urban area within 10 min walk from some green space (=6), In large urban area more than 10 min walk away from any green space (=7)

The independent variables—'Financial situation before the COVID-19 epidemic' were only involved in the models of e-commerce food consumption before the epidemic (Model 1, Model 3, Model 5); the independent variable—'Financial situation during the COVID-19 epidemic' was only involved in the models of e-commerce food consumption during the epidemic (Model 2, Model 4, Model 6)

Table 4 Participants' food consumption with B2C/O2O-FDS/C&C

	Auckland	London	Copenhagen	Total sample
Sample size (n=)	497	493	471	1461
<i>B2C consumption before the COVID-19 epidemic¹***</i>				<i>B2C^b***</i>
Never	63.0%	53.8%	30.1%	49.3%
Once each month or less	28.4%	31.4%	36.3%	32.0%
Twice each month or more	8.7%	14.8%	33.5%	18.8%
<i>B2C consumption during the COVID-19 epidemic^a***</i>				
Never	51.5%	43.4%	24.2%	40.0%
Once each month or less	31.6%	31.0%	39.1%	33.8%
Twice each month or more	16.9%	25.6%	36.7%	26.2%
<i>O2O-FDS consumption before the COVID-19 epidemic¹***</i>				<i>O2O-FDS^b***</i>
Never	43.1%	31.2%	24.8%	33.2%
Once each month or less	44.9%	49.3%	40.1%	44.8%
Twice each month or more	12.1%	19.5%	35.0%	22.0%
<i>O2O-FDS consumption during the COVID-19 epidemic^a***</i>				
Never	42.1%	26.0%	21.0%	29.8%
Once each month or less	38.0%	40.6%	41.4%	40.0%
Twice each month or more	19.9%	33.5%	37.6%	30.2%
<i>C&C consumption before the COVID-19 epidemic^a***</i>				<i>C&C^b***</i>
Never	53.3%	51.9%	29.1%	45.0%
Once each month or less	38.8%	37.3%	39.5%	38.5%
Twice each month or more	7.8%	10.8%	31.4%	16.4%
<i>C&C consumption during the COVID-19 epidemic^a***</i>				
Never	42.3%	48.5%	22.9%	38.1%
Once each month or less	40.2%	32.7%	43.7%	38.8%
Twice each month or more	17.5%	18.9%	33.3%	23.1%

***p < 0.001

^aResults from Chi-square tests among the three cities^bResults from Chi-square tests for contingency tables of the B2C/O2O-FDS/C&C consumption between before and during the COVID-19 epidemic in the pooled sample

least food consumption frequencies for all three e-commerce modes before and during the COVID-19 epidemic among the participants of the three countries.

Table 5 demonstrates the outputs of the ordered logistic regressions regarding the factors driving the food consumption frequencies with B2C (Models 1 and 2), O2O-FDS (Models 3 and 4), and C&C (Models 5 and 6). The following sub-sections will summarise and discuss the significant findings.

Table 5 Results of the ordered logistic regressions regarding the significant factors driving consumer adoption of B2C/O2O-FDS/C&C food shopping: odds ratio

Independent variables	B2C		O2O-FDS		C&C	
	Before COVID-19 (Model 1)	During COVID-19 (Model 2)	Before COVID-19 (Model 3)	During COVID-19 (Model 4)	Before COVID-19 (Model 5)	During COVID-19 (Model 6)
City (Auckland)	0.31 ^{***}	0.37 ^{***}	0.36 ^{***}	0.37 ^{***}	0.38 ^{***}	0.53 ^{***}
City (London)	0.47 ^{***}	0.58 ^{***}	0.66 ^{***}	0.94 ^{***}	0.42 ^{***}	0.46 ^{***}
Menu visual appeal	1.13 [*]	1.15 ^{**}	1.05	1.13 ^{**}	1.07	1.03
Menu informativeness	0.93	1.00	1.03	0.99	0.97	1.06
Trustworthiness	0.90	0.99	0.99	1.06	0.85 ^{**}	0.86 [*]
Customer-service quality	0.93	0.96	0.88 [*]	0.95	0.95	0.97
Perceived risk	0.96	0.94	0.97	0.98	1.02	1.01
Perceived compatibility	1.09	1.05	1.06	0.99	1.07	1.03
Perceived ease	1.14 [*]	1.08	1.03	1.04	0.96	1.04
Social norm	1.08	1.05	1.14 ^{**}	1.05	1.19 ^{***}	1.11 [*]
Unavailable offline	1.10 ^{**}	1.04	1.03	0.98	1.03	1.05
Contactless delivery/collection	1.09 [*]	1.14 ^{**}	1.09 [*]	1.08 [*]	1.09 [*]	1.12 ^{**}
Value for money	0.99	0.91	1.01	0.98	0.96	0.93
Discount	1.09	1.05	1.04	0.99	1.13 ^{**}	1.07
Variety	0.99	1.03	1.01	1.00	0.92	0.96
Safety concern	0.96	0.94	1.17 ^{**}	1.06	1.06	0.97
Quality concern	0.89	0.94	0.87 ^{**}	0.83 ^{**}	0.95	0.92
Others' reviews	0.96	0.91	0.90 [*]	0.95	0.95	0.99
Sensory appeal	0.97	0.95	1.10 [*]	1.03	1.11 [*]	0.98
Affordability	0.89	0.94	0.83 ^{**}	0.86 ^{**}	0.86 ^{**}	0.96
Mood	1.22 ^{***}	1.13 ^{**}	1.08 [*]	1.07	1.20 ^{***}	1.14 ^{**}
Purchase convenience	0.97	1.01	1.05	1.15 [*]	0.99	1.01
Processed convenience	1.10	1.13 [*]	0.99	1.10	0.99	1.08
Financial situation	1.07	1.01	1.07	1.04	1.11 ^{**}	1.00
Gender (male)	1.23	1.15	1.16	1.21	1.09	1.04

Table 5 (continued)

Independent variables	B2C		O2O-FDS		C&C	
	Before COVID-19 (Model 1)	During COVID-19 (Model 2)	Before COVID-19 (Model 3)	During COVID-19 (Model 4)	Before COVID-19 (Model 5)	During COVID-19 (Model 6)
Occupation (self-employed)	2.72*	1.77	1.50	1.46	1.61	0.99
Occupation (managing employee)	2.98*	2.24*	1.68	1.63	1.84	1.45
Occupation (salaried employee)	2.04	1.22	1.25	1.06	1.45	0.92
Occupation (worker)	1.90	1.71	1.57	1.55	1.46	1.16
Occupation (student)	1.51	1.20	0.56	0.59	0.73	0.69
Occupation (unemployed/ retired, housewife/ houseman or on leave)	2.06	1.15	1.00	0.98	1.04	0.67
Age	0.96***	0.96***	0.96***	0.95***	0.96***	0.96***
Household size	1.02	1.06	1.00	1.01	1.06	1.07
Marital status (married)	1.50**	1.35*	1.46*	1.40*	1.33	1.49**
Marital status (single)	0.78	0.80	0.74*	0.70*	0.80	0.91
Education	1.12*	1.15**	0.98	1.01	1.07	1.04
Residential place (rural/urban)	0.92	1.02	1.10*	1.15**	0.90*	0.96
Model fit						
Chi ²	532.10	429.47	397.29	428.00	514.35	412.62
Prob > Chi ²	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R ²	0.177	0.135	0.128	0.134	0.172	0.131

An odds ratio above 1 indicates a positive effect of the factor on the adoption of B2C/O2O-FDS/C&C food shopping, while an odds ratio below 1 indicates a negative effect of the factor on the adoption of B2C/O2O-FDS/C&C food shopping; please refer to Table 3 for all the dependent and independent variables involved in each regression model

*p < 0.05

**p < 0.01

***p < 0.001

4.2 Influences of e-service quality on e-commerce food shopping

According to e-service quality attributes, menu visual appeal, trustworthiness and customer-service quality are significantly linked to the food consumption with one or several of the three e-commerce modes. As such, H1a-c are partially supported. There have been many previously published studies indicating the significant influences of e-service quality attributes on consumer adoption of O2O-FDS [5, 9–11]. Our findings alleviate the lack of understanding of the influence of e-service quality attributes on consumer adoption of food shopping with the B2C and C&C e-commerce modes.

Visual menu appeal is positively correlated with B2C food shopping both before and during the epidemic, as well as O2O-FDS food shopping during the epidemic. This is consistent with previous research emphasizing the significance of effective e-commerce app/platform design and image layout in capturing consumers' attention toward food and restaurants, particularly within the O2O-FDS app/platform [5, 9–11]. As the O2O-FDS platform mainly caters to restaurant meal consumption, a well-designed image layout and meal presentation on the app/platform play a crucial role in stimulating consumers' appetite and influencing their final decision to make a purchase [5, 9–11]. Our study is the first to highlight the same importance of visual menu appeal in the context of B2C food shopping.

Customer-service quality is negatively associated with O2O-FDS food shopping before the epidemic. Trustworthiness is negatively associated with consumer adoption of C&C food shopping before and during the epidemic. This highlights the fact that customer support and the trustworthiness of sellers still pose barriers for consumers when it comes to adopting food shopping with O2O platforms/apps in Western countries. Recent studies also indicate increasing issues of trustworthiness for O2O-FDS platforms/apps in China, stemming from numerous unlicensed O2O-FDS restaurants using low-quality food ingredients in their delivered meals [19, 57]. It is essential for the O2O industry in developed Western countries (e.g. NZ, the UK, and Denmark) to take note of these issues and prevent them.

4.3 Influences of innovation-adoption characteristics on e-commerce food shopping

Regarding IACs, perceived ease and social norm are significantly linked to the food consumption with one or several of the three e-commerce modes. As such, H2a-c are partially supported. Social norm has a significantly positive relationship with O2O-FDS food shopping before the epidemic, and C&C food shopping before and during the epidemic. This fits with the previous findings about the positive influences of perceived incentives (e.g. peer pressure) on consumers adoption of e-commerce food shopping [8, 10, 19, 26].

Perceived ease (the reversed measurement for perceived complexity) is significantly and positively linked to B2C food shopping before the epidemic. Previous studies provide conflicting findings. Some scholars indicate the significant influence of perceived ease/complexity on consumer adoption of food shopping with B2C and

O2O-FDS; meanwhile other scholars cannot find the same significant influence of this in their studies [8, 15, 19, 26]. Our study shows that perceived complexity (e.g. if the modes are easy to use) is still a barrier for consumer adoption of food shopping with B2C in developed Western countries.

4.4 Influences of e-commerce food choice motives on e-commerce food shopping

The following EFCMs are significantly linked to the food consumption with one or several of the three e-commerce modes: unavailable offline, contactless delivery/collection, discount, safety concern, quality concern, others' reviews, sensory appeal, affordability, mood, purchase convenience and processed convenience. As such, H3a-c are partially supported. Previous studies indicate the significantly negative relationship of taste appeal on consumers' purchase intentions toward O2O-FDS in China due to low quality and bad-tasting meals provided by a number of unlicensed restaurants on the Chinese O2O-FDS platforms [3, 19, 57]. Our study is the first to explore the influence of sensory appeal as a general EFCM (e.g. taste, texture, smell, and appearance) on consumer adoption of e-commerce food shopping. The study has found its significantly positive relationship with O2O-FDS and C&C food shopping before the epidemic. This indicates that unlicensed restaurants on O2O platforms are not an issue, and consumers have positive sensory experiences regarding food/meals ordered from O2O platforms in developed Western countries.

Mood is significantly and positively linked to the food shopping with all the three e-commerce modes. This corresponds with the significantly positive influence of hedonic motivation on consumer adoption of O2O-FDS [15, 16]. Therefore, our findings indicate that consumers seek mood enhancement (e.g. relaxation and fun) through e-commerce food shopping in Western countries.

Affordability has a significantly negative relationship with O2O-FDS food shopping before and during the epidemic, and C&C food shopping before the epidemic. Previous studies provide conflicting results about the influences of price concern on consumer adoption of e-commerce food shopping. One study indicates the non-significant influence of price concern on the adoption of four e-commerce food shopping modes B2C, O2O-FDS, O2O-IS and New Retail [3]. Another study points out the significantly negative influence of price concern on the adoption of O2O-FDS [19]. In two other studies, price concern is found to have a significantly positive influence on consumers' satisfaction before or during the epidemic [10, 15]. Our findings indicate that e-commerce food shopping might still not be competitive in price value compared to the food products/services sold in traditional offline channels in Western countries. As such, price concern is still a barrier for consumer adoption of e-commerce food shopping in Western countries.

Another price-related EFCM—discount—has a significantly positive relationship with C&C food shopping before the epidemic. Previous studies indicate that discount is a major marketing approach to attracting price-sensitive consumers to adopt O2O-FDS [5]. While our findings only show the significant influence for the C&C mode, rather than for the B2C and O2O-FDS modes. This inclines toward the

previous findings regarding the non-significant influence of discount on consumer adoption of food shopping with O2O-FDS and B2C in China [3, 19].

Others' reviews had a significantly negative influence on O2O-FDS food shopping before the epidemic. This is not consistent with previous studies that indicate the positive influence of others' opinions, ratings and reviews on consumer adoption of B2C food shopping, and the non-significant influence of online reviews on O2O-FDS food shopping [3, 19, 39]. Our findings might be a reflection of consumers' dissatisfaction with food shopping on the immature O2O-FDS platforms in Western countries; they may accept many negative and unpleasant opinions, ratings and reviews from other users with regard to it.

Safety concern is positively and significantly linked to O2O-FDS food shopping before the epidemic. This is in line with the previous findings about consumers' positive safety perceptions toward O2O-FDS [8, 11, 19]. This may be caused by the easier access of safety-related food and ingredient information about the ordered foods and meals on O2O-FDS platforms than the offline purchase of foods and meals in local retailers and restaurants [19].

Quality concern has a significantly negative impact on O2O-FDS food shopping before and during the epidemic. Food quality is a key factor in influencing consumers' repurchase in the O2O-FDS mode [5, 11]. One study indicates significant impacts of quality concern on food shopping with B2C and O2O-FDS in China, which Chinese consumers have positive perceptions toward the quality of food products purchased from B2C and O2O-FDS platforms [3]. While our findings indicate that Western consumers in general have negative impressions of the food quality from O2O-FDS platforms.

Purchase convenience has a significantly positive influence on O2O-FDS food shopping during the epidemic. Processed convenience has a significantly positive influence on the B2C food shopping during the epidemic. Convenience (e.g. saving purchase or cooking time) is highlighted by most previous relevant studies as the most significant advantage of e-commerce food shopping compared to traditional offline food shopping [9, 10, 58, 59]. Our finding aligns with the significantly positive influence of processed convenience on consumer adoption of O2O-FDS, as recognized by a previous study [3]. Further, previous studies provide conflicting findings about the influence of purchase convenience on consumer adoption of e-commerce food shopping. This has a positive influence on consumers' attitudes toward food shopping with B2C and O2O-FDS, but a negative influence on their purchase intention toward O2O-FDS in China and/or Thailand [3, 10, 19]. Our findings may reflect that Western consumers have favorable impressions of purchase convenience, such as time-saving, in the context of O2O-FDS food shopping.

Unavailable offline has a significantly positive influence on B2C food shopping before the epidemic. Meanwhile contactless delivery/collection has a significantly positive influence on food shopping with all the three e-commerce modes. All these findings reflect the advantages of e-commerce food shopping (e.g. avoidance of physically contacting sellers, and the sale of offline shortage food) compared to traditional offline food shopping. These advantages have resulted in the increased acceptance of e-commerce food shopping by consumers during the epidemic, globally [8, 11, 37, 45–49].

4.5 Influences of socio-demographics on e-commerce food shopping

The following socio-demographics are significantly linked to the food consumption with one or several of the three e-commerce modes: age, financial situation, occupation, marital status, education and residential place (rural/urban). As such, H4a-c are partially supported. Age is significantly and negatively linked to food shopping with all three e-commerce modes. This is in line with the previous findings that young people are more likely to accept e-commerce food shopping than old people [3, 12, 19]. This is reasonable. E-commerce food shopping is an innovative food consumption pattern, particularly in Western developed countries. Young people are consistently pioneers in their adoption of food innovation [60].

Education is significantly and positively linked to B2C food shopping before and during the epidemic. In addition, the financial situation also has a significantly positive relationship with C&C food shopping before the epidemic. This corresponds with the previous findings that those consumers who have a higher level of education and income are more likely to adopt e-commerce food shopping than their counterparts with a lower level of education and income [3, 19, 26].

Regarding occupation, being self-employed and managing employees have a significantly positive relationship with the B2C food shopping. Previous studies have indicated the significant influence of occupation on consumer adoption of e-commerce food shopping. Consumers with a high or middle level of occupation are more willing to accept O2O-FDS, while self-employed people and workers are less likely to accept it; these are results from a pooled sample of China and NZ [19]. Furthermore, students are less likely to purchase food with B2C platforms in China [3, 26]. Our findings suggest that self-employed individuals and managing employees in Western countries are more inclined to shop for food through B2C platforms.

Place of residence (rural/urban) has a significant influence on O2O-FDS food shopping before and during the epidemic, and C&C food shopping before the epidemic. Urban consumers are more willing to use O2O-FDS. This corresponds with the previous findings that consumers who live in a more urbanised area are more likely to purchase food with B2C and O2O-FDS platforms in order to save time and deal with their stressful and fast-paced city lives than their counterparts living in a less urbanised area [3, 13, 19]. Furthermore, our study is the first to indicate the significant influence of residential place on C&C food shopping. Rural consumers are more willing to purchase food through C&C platforms than urban consumers. Western developed countries have a low-population base and a high vehicle ownership ratio compared to Asian developing countries [17]. From this perspective, C&C might be a more suitable e-commerce food shopping mode for rural consumers in Western developed countries; they could conveniently drive through, and pick up their ordered food, and at the same time save the high delivery fee due to the long distance between their homes and food sectors, compared to O2O-FDS.

Regarding marital status, being married is significantly and positively associated with food shopping through all three e-commerce modes. In contrast, being single is significantly and negatively associated with O2O-FDS food shopping. This aligns with previous findings that married individuals are more willing to shop for food through B2C and O2O platforms because they tend to cook for their families and

share meals with family members more frequently than single individuals [3, 19, 26].

In terms of country of residence, Auckland and London are both significantly and negatively associated with food shopping through all three e-commerce modes. In other words, this suggests a significantly positive association between Copenhagen and e-commerce food shopping. This corroborates the descriptive findings of e-commerce food shopping frequencies in these three cities within this study (see Sect. 4.1).

4.6 Comparison between e-commerce food shopping modes

Table 5 highlights both the evident similarities and differences in how various factors influence the food shopping behavior of Western consumers across three e-commerce modes. Factors such as contactless delivery/collection, mood, younger age, and marital status exhibit significant and positive associations with all three e-commerce food shopping modes. This pattern reflects the typical profile of e-commerce food shoppers in Western countries, which comprises mainly young married individuals. Furthermore, it appears that these consumers view e-commerce food shopping as a means to enhance their hedonic motivation and avoid the need for physical interaction associated with traditional offline food shopping.

When it comes to differences, B2C is significantly associated with perceived ease, unavailable offline, processed convenience, education, and occupations related to self-employment and managing employee. O2O-FDS is significantly associated with customer-service quality, safety concern, quality concern, others' reviews and purchase convenience. C&C is significantly associated with trustworthiness, discount, and financial situations. These significant relationships are not observed in the other two e-commerce food shopping modes in the findings. Additionally, the two O2O modes, O2O-FDS and C&C, are significantly associated with social norm, sensory appeal, affordability and residential place (rural/urban). These significant relationships are not found in B2C food shopping.

The differences may be attributed to variations in business types and consumers' categorical preferences across e-commerce modes. B2C shops operate exclusively online and do not have physical stores in consumers' local regions [3, 26]. Previous studies have shown that consumers prefer using B2C for purchasing processed and packaged food products [3, 26]. There has also been a rapid global growth in the B2C market for fresh food and meal kits [4, 13, 36, 61]. Consequently, the primary reason consumers use B2C is for the easy purchase of food ingredients that are not available offline, enhancing cooking convenience. This innovative food purchasing pattern, which involves ordering and making payments online from non-local physical shops, may be more manageable for individuals with a high level of education and those in occupations requiring self-employment or employee management, which also typically involves a higher level of education.

On the other hand, O2O (O2O-FDS, O2O-IS, and C&C) involves the e-commercialization of food businesses operated by local physical retailers and restaurants [3, 19, 27]. Local restaurant meals are the most commonly consumed food category in

O2O food shopping [3, 9, 10, 26]. As a result, consumers' decisions when purchasing meals through O2O platforms are heavily influenced by factors related to meal service quality such as customer service (e.g. delivery service quality), restaurant reputation (e.g. trustworthiness and others' reviews), delivery/collection distance (e.g. residential location), as well as meal quality (e.g. food quality, safety and sensory attributes). Additionally, price-related factors (e.g. financial situation, discounts and affordability) also play a significant role in consumers' decision-making when using O2O for meal shopping. This may be attributed to the considerably higher cost of dining out (including take-away services), primarily due to high labor costs, as compared to cooking at home in Western developed countries [62, 63].

4.7 Comparison between the West and the East

In general, the factorial influences on the adoption of e-commerce food shopping among Western consumers are quite similar to those among their counterparts in Asia, with the following e-service quality, IAC, EFCM and socio-demographic factors significantly influencing food shopping with B2C and/or O2O-FDS modes: menu visual appeal, customer-service quality, perceived ease, social norm, safety concern, quality concern, sensory appeal, unavailability offline, contactless delivery/collection, affordability, others' reviews, mood, convenience, occupation, residential place, education, marital status and age [3, 5–8, 10–16, 19, 26, 45–49, 64–66]. Additionally, this study is the first to recognize the significant influence of several e-service quality, IAC, EFCM, and socio-demographic factors on C&C food shopping. While only a few significant factors in B2C and O2O-FDS food shopping among Asian consumers do not show the same significant relationships with e-commerce food shopping among Western consumers in our study, including household size, menu informativeness, value for money and perceived compatibility [3, 5, 19, 26]. All these results indicate the high reliability of IACs, e-service quality, socio-demographics and EFCMs as instruments to predict consumers' e-commerce food shopping behaviours, whether in the East or the West.

5 Conclusion and implications

5.1 Academic implications

This study makes numerous academic contributions. As one of the few empirical studies boasting a large sample size, it stands out as the first to systematically explore the significant influential factors on e-commerce food shopping. This exploration is facilitated through a comprehensive model developed based on all the relevant theories and factors associated with e-commerce food shopping, including EFCMs, IACs, e-service quality attributes, and socio-demographics. Furthermore, it marks the second study globally and the first in the Western world to compare the influences of these factors across multiple e-commerce food shopping modes. In our

case, we examine the distinctions between B2C, O2O-FDS and C&C. Our findings also confirm the different influences of these factors on Western consumer adoption of food shopping through various e-commerce modes. Additionally, this study is the first quantitative research with a large sample size to explore the influence of these factors on consumers' C&C food shopping globally.

It's worth noting that previous empirical consumer studies on e-commerce food shopping were often conducted using Asian-based samples with small sample sizes. In this regard, our study is the first to confirm the high reliability of IACs, e-service quality, socio-demographics and EFCMs as instruments to predict consumers' e-commerce food shopping behaviors, whether in the East or the West. In summary, our study, conducted in a highly reliable and valid manner, provides foundational methods and insights that can inform and enlighten future exploratory and confirmatory research into consumer adoption of e-commerce food shopping, both in Eastern and Western countries.

5.2 Managerial implications

The findings also have significant managerial implications. Stakeholders in the food industry can now have a better and more comprehensive understanding of e-commerce food consumer behaviors in Western developed countries. Understanding the key factors that influence e-commerce food shopping behavior among Western consumers is crucial for businesses seeking to thrive in this dynamic market. The evident similarities in preferences, such as the significantly positive influences of contactless delivery/collection, mood, younger age and marital status across all three modes (B2C, O2O-FDS, and C&C), suggest a common profile of predominantly young married individuals engaging in e-commerce food shopping and their significant reasons for using e-commerce food shopping to enhance hedonic motivation and reduce traditional offline physical communication with others. Therefore, promotion strategies for all e-commerce food shopping modes should be crafted to emphasize these aspects, such as 'getting relieved', 'enhancing your mood', 'young married couples', and 'enriching your individual space'.

However, the differences observed, particularly in significant factors associated with each e-commerce mode, demand a differentiated approach when making promotion strategies. For B2C, it should emphasize the innovative and simple ordering pattern from non-local physical shops for unique ingredients, appealing to those seeking to enhance cooking convenience. This is particularly crucial among B2C pioneers, who often possess higher education levels and hold specific occupations related to self-employment and managerial roles. On the other hand, O2O modes, notably O2O-FDS and C&C, are strongly linked to considerations of food quality, safety, service quality, reviews, trustworthiness and affordability. This indicates that O2O platforms should collaborate with local restaurants known for high meal quality and a good reputation. They should also develop promotion strategies to meet the cost-conscious nature of consumers for the O2O modes. Particular attention should be paid to recognizing user profiles based on the obvious differences in residential places for these two modes.

Urban consumers are pioneers for O2O-FDS, while their counterparts in rural areas are pioneers for C&C.

5.3 Limitations and future work

This study has several limitations. Firstly, it compared consumer adoption of food shopping through only three e-commerce modes: B2C, O2O-FDS and C&C. Future studies should consider exploring other significant e-commerce food shopping modes like O2O-IS, New Retail and the rising mode of live streaming e-commerce.

Secondly, this study focused on systematically understanding the significant factors influencing Western consumer adoption of multiple e-commerce food shopping modes by utilizing a comprehensive model. The data were collected solely from three Western countries. However, there is also a lack of understanding this significant area in non-Western settings, such as Asia. Future studies should consider including non-Western samples to broaden the scope.

Thirdly, the data for this study were gathered only from the largest cities in NZ, the UK, and Denmark (specifically Auckland, London, and Copenhagen). To better understand regional similarities and differences within these three countries, future studies should involve nationally representative data collection.

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Declarations

Conflict of interest No potential conflict of interest was reported by the authors.

Ethical approval This study was approved by the Waikato Management School Research Ethics Committee.

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References

1. Grashuis, J., Skevas, T., & Segovia, M. S. (2020). Grocery shopping preferences during the COVID-19 pandemic. *Sustainability*, *12*(13), 5369.
2. Johnson, J. S. (2020). COVID-19 and e-commerce are changing retailers' real estate footprints. Retrieved November 25, 2021, from <https://www.natlawreview.com/article/covid-19-and-e-commerce-are-changing-retailers-real-estate-footprints>
3. Wang, O., Somogyi, S., & Charlebois, S. (2020). Food choice in the e-commerce era: A comparison between Business-To-Consumer (B2C), Online-To-Offline (O2O) and New Retail. *British Food Journal*, *122*(4), 1215–1237.
4. Chang, H. H., & Meyerhoefer, C. D. (2021). COVID-19 and the demand for online food shopping services: Empirical evidence from Taiwan. *American Journal of Agricultural Economics*, *103*(2), 448–465.
5. Wang, O. (2020). Consumer adoption of online-to-offline food delivery services: A conceptual model. In F. Martínez-López & S. D'Alessandro (Eds.), *Advances in digital marketing and e-commerce. Springer proceedings in business and economics*. Springer.
6. Ali, S., Khalid, N., Javed, H. M. U., & Islam, D. M. (2021). Consumer adoption of online food delivery ordering (OFDO) services in Pakistan: The impact of the COVID-19 pandemic situation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 10.
7. Alaimo, L. S., Fiore, M., & Galati, A. (2022). Measuring consumers' level of satisfaction for online food shopping during COVID-19 in Italy using POSETs. *Socio-Economic Planning Sciences*, *82*, 101064.
8. Al Amin, M., Arefin, M. S., Alam, M. R., Ahammad, T., & Hoque, M. R. (2021). Using mobile food delivery applications during COVID-19 pandemic: An extended model of planned behavior. *Journal of Food Products Marketing*, *27*(2), 105–126.
9. Brewer, P., & Sebby, A. G. (2021). The effect of online restaurant menus on consumers' purchase intentions during the COVID-19 pandemic. *International Journal of Hospitality Management*, *94*, 102777.
10. Chotigo, J., & Kadono, Y. (2021). Comparative analysis of key factors encouraging food delivery app adoption before and during the COVID-19 pandemic in Thailand. *Sustainability*, *13*(8), 4088.
11. Dsouza, D., & Sharma, D. (2020). Online food delivery portals during COVID-19 times: An analysis of changing consumer behavior and expectations. *International Journal of Innovation Science*, *13*(2), 218–232.
12. Gao, X., Shi, X., Guo, H., & Liu, Y. (2020). To buy or not buy food online: The impact of the COVID-19 epidemic on the adoption of e-commerce in China. *PLoS ONE*, *15*(8), e0237900.
13. Lu, M., Wang, R., & Li, P. (2021). Comparative analysis of online fresh food shopping behavior during normal and COVID-19 crisis periods. *British Food Journal*, *124*(3), 968–986.
14. Nguyen, C., Tran, D., Nguyen, A., & Nguyen, N. (2021). The effects of perceived risks on food purchase intention: The case study of online shopping channels during COVID-19 pandemic in Vietnam. *Journal of Distribution Science*, *19*(9), 19–27.
15. Prasetyo, Y. T., Tanto, H., Mariyanto, M., Hanjaya, C., Young, M. N., Persada, S. F., Miraja, B. A., & Redi, A. A. N. P. (2021). Factors affecting customer satisfaction and loyalty in online food delivery service during the covid-19 pandemic: Its relation with open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 76.
16. Zanetta, L. D. A., Hakim, M. P., Gastaldi, G. B., Seabra, L. M. A. J., Rolim, P. M., Nascimento, L. G. P., & da Cunha, D. T. (2021). The use of food delivery apps during the COVID-19 pandemic in Brazil: The role of solidarity, perceived risk, and regional aspects. *Food Research International*, *149*, 110671.
17. Lau, E. (2021). New study reveals which country in the world has the most cars per capita. Retrieved January 6, 2022, from <https://www.thenationalnews.com/lifestyle/motoring/2021/08/16/new-study-reveals-which-country-in-the-world-has-the-most-cars-per-capita/>
18. Duthoit, A. (2021). European food retailers: The bitter digital aftertaste of the Covid-19 legacy. Retrieved November 25, 2021, from https://www.eulerhermes.com/en_global/news-insights/economic-insights/European-food-retailers-The-bitter-digital-aftertaste-of-the-Covid-19-legacy.html
19. Wang, O., & Scrimgeour, F. (2022). Consumer adoption of online-to-offline food delivery services in China and New Zealand. *British Food Journal*, *124*(5), 1590–1608.

20. Wells, J. (2021). Food and beverage will lead online sales growth through 2024, Forrester says. Retrieved November 25, 2021, from <https://www.grocerydive.com/news/food-and-beverage-will-lead-online-sales-growth-through-2024-forrester-say/603161/>
21. Armstrong, B., & Reynolds, C. (2020). China and the USA, a higher perceived risk for UK consumers in a post COVID-19 food system: The impact of country of origin and ethical information on consumer perceptions of food. *Emerald Open Research*, 2(35), 35.
22. Fuentes, C., Samsioe, E., & Östrup Backe, J. (2022). Online food shopping reinvented: Developing digitally enabled coping strategies in times of crisis. *The International Review of Retail, Distribution and Consumer Research*, 32(2), 130–150.
23. Dai, H., Xiao, Q., Yan, N., Xu, X., & Tong, T. (2022). What influences online sales across different types of e-commerce platforms. *International Journal of Electronic Commerce*, 26(3), 311–330.
24. Pu, X., Sun, S., & Shao, J. (2020). Direct selling, reselling, or agency selling? Manufacturer's online distribution strategies and their impact. *International Journal of Electronic Commerce*, 24(2), 232–254.
25. Weber, A., & Maier, E. (2020). Reducing competitive research shopping with cross-channel delivery. *International Journal of Electronic Commerce*, 24(1), 78–106.
26. Wang, O., & Somogyi, S. (2018). Consumer adoption of online food shopping in China. *British Food Journal*, 120(12), 2868–2884.
27. Fang, J., Hu, L., Hossain, M. A., Yang, J., & Shao, Y. (2019). Polluted online reviews: The effect of air pollution on reviewer behavior. *International Journal of Electronic Commerce*, 23(4), 557–594.
28. Xiao, L., Mi, C., Zhang, Y., & Ma, J. (2019). Examining consumers' behavioral intention in O2O commerce from a relational perspective: An exploratory study. *Information Systems Frontiers*, 21(5), 1045–1068.
29. Xiao, L., Fu, B., & Liu, W. (2018). Understanding consumer repurchase intention on O2O platforms: An integrated model of network externalities and trust transfer theory. *Service Business*, 12(4), 731–756.
30. Jara, M., Vyt, D., Mevel, O., Morvan, T., & Morvan, N. (2018). Measuring customers benefits of click and collect. *Journal of Services Marketing*, 32(4), 430–442.
31. Wang, X., & Ng, C. T. (2020). New retail versus traditional retail in e-commerce: Channel establishment, price competition, and consumer recognition. *Annals of Operations Research*, 291(1), 921–937.
32. Aiswarya, R. S., Kumar, V., & Punitha, P. (2023). The effect of grain size and silicon content on non-oriented grain steel anomalous loss through frequency excitation in the medical healthcare by using big data analysis. *Tamjeed Journal of Healthcare Engineering and Science Technology*, 1(1), 43–53.
33. Kumar, B. S., & Mohammed, B. S. (2023). Detection of human protein structures by select deep learning models and dynamic systems. *Tamjeed Journal of Healthcare Engineering and Science Technology*, 1(1), 35–42.
34. Sivaparthipan, C. B., & Karthick, M. (2023). Accessibility study of mHealth systems based on the internet of things (IoT). *Tamjeed Journal of Healthcare Engineering and Science Technology*, 1(1), 14–23.
35. Huberman, J. (2021). Amazon Go, surveillance capitalism, and the ideology of convenience. *Economic Anthropology*, 8(2), 337–349.
36. Wang, O., Somogyi, S., & Ablett, R. (2021). The influences of quality attributes and socio-demographics on Chinese consumers' general and online consumptions of Canadian, U.S. and Australian lobsters. *British Food Journal*, 123(7), 2289–2306.
37. Ben Hassen, T., El Bilali, H., Allahyari, S., & M. (2020). Impact of COVID-19 on food behavior and consumption in Qatar. *Sustainability*, 12(17), 6973.
38. Wang, O., & Scrimgeour, F. (2023). Consumer adoption of blockchain food traceability: Effects of innovation-adoption characteristics, expertise in food traceability and blockchain technology, and segmentation. *British Food Journal*, 125(7), 2493–2513.
39. Hansen, T. (2005). Consumer adoption of online grocery buying: A discriminant analysis. *International Journal of Retail & Distribution Management*, 33(2), 101–121.
40. Onwezen, M. C., Reinders, M. J., Verain, M. C. D., & Snoek, H. M. (2019). The development of a single-item Food Choice Questionnaire. *Food Quality and Preference*, 71, 34–45.
41. Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite*, 25(3), 267–284.

42. Fu, H., Manogaran, G., Wu, K., Cao, M., Jiang, S., & Yang, A. (2020). Intelligent decision-making of online shopping behavior based on internet of things. *International Journal of Information Management*, 50, 515–525.
43. Zhao, C., & Wang, C. A. (2021). A cross-site comparison of online review manipulation using Benford's law. *Electronic Commerce Research*, 23, 365–406.
44. Zhou, C., Yang, S., Chen, Y., Zhou, S., Li, Y., & Qazi, A. (2023). How does topic consistency affect online review helpfulness? The role of review emotional intensity. *Electronic Commerce Research*, 23, 2943–2978.
45. Chenarides, L., Grebitus, C., Lusk, J. L., & Printezis, I. (2021). Food consumption behavior during the COVID-19 pandemic. *Agribusiness*, 37(1), 44–81.
46. Wang, X., Wong, Y. D., Qi, G., & Yuen, K. F. (2021). Contactless channel for shopping and delivery in the context of social distancing in response to COVID-19 pandemic. *Electronic Commerce Research and Applications*, 48, 101075.
47. Jeżewska-Zychowicz, M., Plichta, M., & Królak, M. (2020). Consumers' fears regarding food availability and purchasing behaviors during the COVID-19 pandemic: The importance of trust and perceived stress. *Nutrients*, 12(9), 2852.
48. Lehberger, M., Kleih, A. K., & Sparke, K. (2021). Panic buying in times of coronavirus (COVID-19): Extending the theory of planned behavior to understand the stockpiling of nonperishable food in Germany. *Appetite*, 161, 105118.
49. Wang, E., An, N., Gao, Z., Kiprop, E., & Geng, X. (2020). Consumer food stockpiling behavior and willingness to pay for food reserves in COVID-19. *Food Security*, 12(4), 739–747.
50. Shamim, K., Ahmad, S., & Alam, M. A. (2021). COVID-19 health safety practices: Influence on grocery shopping behavior. *Journal of Public Affairs*, 21(4), e2624.
51. Roh, M., & Park, K. (2019). Adoption of O2O food delivery services in South Korea: The moderating role of moral obligation in meal preparation. *International Journal of Information Management*, 47, 262–273.
52. Bryła, P. (2018). Organic food online shopping in Poland. *British Food Journal*, 120(5), 1015–1027.
53. Jin, S., Li, H., & Li, Y. (2017). Preferences of Chinese consumers for the attributes of fresh produce portfolios in an e-commerce environment. *British Food Journal*, 119(4), 817–829.
54. Morganosky, M. A., & Cude, B. J. (2000). Consumer response to online grocery shopping. *International Journal of Retail & Distribution Management*, 28(1), 17–26.
55. Wang, O., Gellynck, X., & Verbeke, W. (2017). Chinese consumers and European beer: Associations between attribute importance, socio-demographics, and consumption. *Appetite*, 108, 416–424.
56. Alkharusi, H. (2012). Categorical variables in regression analysis: A comparison of dummy and effect coding. *International Journal of Education*, 4(2), 202.
57. Li, C., Miroso, M., & Bremer, P. (2020). Review of online food delivery platforms and their impacts on sustainability. *Sustainability*, 12(14), 5528.
58. Saad, A. T. (2021). Factors affecting online food delivery service in Bangladesh: An empirical study. *British Food Journal*, 123(2), 535–550.
59. Cho, M., Bonn, M. A., & Li, J. J. (2019). Differences in perceptions about food delivery apps between single-person and multi-person households. *International Journal of Hospitality Management*, 77, 108–116.
60. Barrena, R., García, T., & Camarena, D. (2015). An analysis of the decision structure for food innovation on the basis of consumer age. *The International Food And Agribusiness Management Review*, 18(3), 149–170.
61. Cang, Y. M., & Wang, D. C. (2021). A comparative study on the online shopping willingness of fresh agricultural products between experienced consumers and potential consumers. *Sustainable Computing: Informatics and Systems*, 30, 100493.
62. Guthrie, G. (2021). Has dining out become too expensive? Here's how you can keep those costs down. Retrieved November 8, 2023, from <https://www.consumeraffairs.com/news/has-dining-out-become-too-expensive-heres-how-you-can-keep-those-costs-down-051623.html>
63. Lisa, A. (2023). How much more \$\$ eating out actually costing you? Retrieved November 8, 2023, from <https://finance.yahoo.com/news/much-extra-does-eating-really-110026810.html>
64. Ray, A., Dhir, A., Bala, P. K., & Kaur, P. (2019). Why do people use food delivery apps (FDA)? A uses and gratification theory perspective. *Journal of Retailing and Consumer Services*, 51, 221–230.
65. Kang, J. W., & Namkung, Y. (2019). The information quality and source credibility matter in customers' evaluation toward food O2O commerce. *International Journal of Hospitality Management*, 78, 189–198.

66. Annaraud, K., & Berezina, K. (2020). Predicting satisfaction and intentions to use online food delivery: What really makes a difference? *Journal of Foodservice Business Research*, 23(4), 305–323.

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