ONLINE FOOD DELIVERY SERVICES USAGE AND ITS ASSOCIATED FACTORS AMONG A WORK POPULATION IN A MIDDLE INCOME COUNTRY, MALAYSIA

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Abstract

Online food delivery services (OFDS) are popular due to its availability and convenience. However, OFDS with increasing food availability and choice, and decreasing barriers to food consumption effort may potentially lead to adverse health outcomes such as overweight/ obesity to the users, which is a public health challenge with increasing prevalence worldwide. Therefore, we aimed to determine the frequency and patterns of OFDS usage and its associated factors (socio-demographic characteristics, weight status and health literacy (HL)) among workers. This was a cross-sectional study conducted among civil servants in Peninsular Malaysia. Data collected were socio-demographic characteristics, body mass index (BMI), levels of HL, frequency and patterns of OFDS usage. There were 656 participants with a mean age of 39.0 (± 6.9) years who were mostly Malays (79.4%) and females (76.4%). The average frequency of OFDS usage was seven times a month with local food being the most frequently ordered type of food (50.3%). Furthermore, coffee and sugar-sweetened beverages (SSBs) were the common types of drinks frequently ordered along with meals. Price was the most important factor (92%) when making food choices. Factors associated with frequent OFDS usage were Malay ethnicity (aOR: 1.78; 95% CI: 1.16, 2.73), high monthly household income (aOR: 2.71, 95% CI: 1.48, 4.97) and age, where the younger the age group, the higher the adjusted odds ratio for its use when compared to the oldest age group. However, there were no associations between frequent OFDS usage with overweight/ obesity and low HL levels. Besides, education levels and occupation were also not associated with frequent OFDS usage. This study contributes to limited studies on OFDS usage and its associated factors among the adult population in Malaysia. Future research could be carried out to explore the association of sociodemography, HL and body mass index among a more diverse Malaysian population.

Keywords: Online Food Delivery Services, Food Delivery, Public Health, Health Literacy (HL), Body Mass Index (BMI)

Introduction

Online food delivery services (OFDS) are internet or application-based services which are used to order and receive ready-to-eat meals (1). These meals can be ordered either directly from food retailers using their own delivery services or through third party platform-to-consumer delivery services offering a wide range of restaurants and meal options.

Over the past decade, food delivery applications have seen a surge in growth by which digital ordering accounted for half of all food delivery visits (2), with increasing global revenue expected to exceed 164.5 billion USD by 2024 (3). Other than the widespread adoption of internet and mobile phone due to advancement of technology, convenience and consumer choice have been reported to be the potential drivers of OFDS usage (4). This phenomenon of ordering food online has burgeoned during the COVID-19 pandemic where lockdowns were implemented to contain the spread of the SARS-CoV-2. Consumers were found to spend three times more on OFDS than they used to during pre-pandemic (5). According to a survey conducted among Malaysians, 22% of them ordered food on food delivery applications once or twice a week (6).

This virtual food environment can affect consumers' food purchasing behaviours and health with the diverse menus, pictures of various food items as well as ratings and reviews available on the food-delivery platforms. Although consumers have the potential to choose healthy options, calorie-dense food were reported to be the most popular choices to be delivered (2). In Australia, about a third of

the famous food outlets on the market-leading OFDS were categorised as "fast-food franchise" stores and the leading OFDS platforms in the country were partnered with the top 10 fast food franchise stores (5). Another study reported that the food available on OFDS had poor diet quality (7). Other than that, the food selection can be influenced by factors like advertisements and promotions (8, 9). Discounts and free delivery were also found to persuade consumers to purchase unhealthy meals (8).

With the increased usage of OFDS and potential to choose unhealthy meals which are greater in portion size, calories and sodium levels, these food delivery applications might intensify the problem of ongoing obesity epidemic which is among the biggest health challenges worldwide (2, 10). According to the National Health and Morbidity Survey (NHMS) 2019, the obesity epidemic in Malaysia is at an alarming trend where half of the adult population were overweight or obese (11). Highly inflammatory food such as sugar-sweetened beverages (SSBs), refined grains, processed meat and other junk food which are widely available on the online food delivery platforms were found to be associated with increased body inflammation, further elevate subsequent risk of heart disease and stroke by 46% and 28% respectively (5).

With the high prevalence of overweight or obesity and increase usage of OFDS, we aimed to conduct a study to describe the frequency and patterns of OFDS usage and the factors associated with frequent and non-frequent users of OFDS among a work population in the central region of Peninsular Malaysia.

Materials and Methods

Sample collection

This cross-sectional study was conducted amongst all civil servants working in the Ministry of Health Headquarters (MOH HQ). This group of workers were selected because they have the highest rate of overweight or obesity (60.3%) in Malaysia (11). Data collection was carried out from mid-January to mid-April 2022. The participants were recruited using the universal sampling method with an online questionnaire disseminated to the staff's official emails. Part-time employees were excluded from this study. Ethical approval was obtained from the Medical Research and Ethics Committee (MREC) (NMRR ID-21-02160-S1R). The participation in this study was voluntary. Written informed consent was obtained from participants prior to data collection.

An online self-administered questionnaire was used in this study. The questionnaire consisted of three parts as follows: Part A collected data on socio-demographic characteristics such as age, ethnicity, gender, highest education level, marital status, monthly household income and occupation as well as weight status of the respondents where the height and weight were self-reported.

Part B assessed the general health literacy (HL) using the Short-Form Health Literacy Instrument (HLS-SF12) which has been validated. The HLS-SF12 was developed based on responses from six countries including Malaysia, retaining the conceptual framework of the European Health Literacy Questionnaire (HLS-EU-Q47) with high reliability (Cronbach's alpha 0.85), good criterion-related validity and moderate and high level of item-scale convergent validity. This instrument measures four competences of health information processing (accessing, understanding, judging and applying) in three domains namely healthcare, disease prevention and health promotion (12).

Part C comprised questions about frequency and patterns of OFDS usage (including type of food frequently ordered, type of meal frequently ordered, amount of money spent per meal per person, frequency of ordering drinks along with meals, type of drinks frequently ordered with meals and consideration of pricing and calorie factor before ordering food). Reasons for ordering food via OFDS were also enquired. Questions in Part C were adapted from two studies (13, 14) with some of the choices for the questions altered to suit the local context. The content validity of the Part C questionnaire was evaluated by six experts mainly academicians, dietitians and nutritionists. This section was assessed on its relevance, clarity, completeness and meaningfulness (Supplementary table 1).

Calculation of content validity indices at the item-level (I-CVI) and scale level (S-CVI) was conducted for all four attributes. The average agreement by experts (S-CVI/Ave) index was calculated based on average proportion of the items on one scale rated three or four (15). The I-CVI and S-CVI/Ave for all items in Part C were acceptable which were at least 0.78 and 0.8 respectively. Besides, the modified Kappa (k*), an index of agreement among the experts showing beyond chance that the items were relevant and clear items was also calculated to be more than 0.74, thereby indicating excellent validity.

The full questionnaire was then pretested among five employees from the same setting. The pretest served to check if the format, content and terminologies used in the questionnaire were suitable. In addition, the understanding of participants and length of time taken by them to complete the questionnaire were also assessed. Those who were involved in the pretest were not included in the actual study.

A sample size of 758, considering a non-response rate of 20% was calculated using odds ratio of socio-demographic characteristics among OFDS users (16). The OpenEpi software was used to calculate the sample size, with power value of 80% and 95% level of significance.

Data analysis

It was determined if participants have ever used OFDS. Then, the OFDS users were enquired on frequency per month. The continuous variable of frequency of OFDS usage (total of OFDS usage per month) was dichotomised

to frequent and non-frequent user using median splitting (median = 4). The participants who used OFDS less than four times a month were categorised as non-frequent users and those who use four times and above were categorised as frequent users.

The ethnicity was further subcategorised into Malay and non-Malay which included Chinese, Indian and other ethnicities. As for the BMI categories, the underweight (BMI < 18.5) and normal weight (BMI 18.5-24.9) participants were grouped into one category and the overweight (BMI 25-29.9) and obese (BMI ≥ 30) participants were grouped into another. HL Index as calculated by the formula (mean-1)*(50/3) was used to standardise the indices for HL to unified metrics from zero to 50, where zero represented the lowest HL and 50 represented the highest HL (17). A score of 33 and below indicates limited literacy, a score of above 33 to 42 indicates sufficient literacy and a score of above 42 indicates excellent literacy.

Data was analysed using SPSS version 25 for descriptive analysis and analytical analysis. Level of significance was preset at 0.05. Apart from participants' socio-demographic characteristics, weight status and HL, descriptive analysis was used to summarise the frequency, patterns and reasons for OFDS usage. Continuous data were expressed as mean ± SD whereas categorical data were expressed as frequency and percentage.

Bivariate analysis was used to determine the association between independent variables (socio-demographic characteristics, weight status and HL) with OFDS (frequent or non-frequent usage). Chi-square test was used for categorical data and independent t test was used for continuous data. A binomial logistic regression was performed to determine factors associated with OFDS usage. Variables which were found to be significant (p-value < 0.25) in the bivariate analysis were included in the multivariable logistic regression model. The adjusted odds ratio (aOR) was reported with 95% confidence interval (CI).

Results

Socio-demographic characteristics, HL index and weight status

A total of 656 out of 4,781 staff working at the MOH HQ participated in this study with response rate of 13.7%. The mean (± SD) age of the participants was 39.0 (± 6.9) years with more than half of them in the age group of 30 to 39 years (Table 1). Most of the participants were Malay (79.4%), female (76.4%), with at least a bachelor's degree (69.5%), married (75.0%), from the middle-income group (48.5%) and worked as a healthcare worker (HCW) (57.9%). Approximately a third of the participants were overweight and 22.1% were obese. The overall mean (± SD) of HL index was 37.00 (± 7.80). The participants were also categorised into three HL levels (limited, sufficient and excellent) according to their mean HL indices with about 45% of them have sufficient HL.

Table 1: Socio-demographic characteristics, weight status and health literacy of participants

Participants' Characteristics	Total (n = 656) n (%)
Socio-demographic characteristics	
Age (mean ± SD)	39.0 (±6.9)
20-29 years	36 (5.5)
30-39 years	344 (52.4)
40-49 years	213 (32.5)
50-59 years	63 (9.6)
Ethnicity	
Malay	521 (79.4)
Chinese	59 (9.0)
Indian	28 (4.3)
Others	48 (7.3)
Gender	
Male	155 (23.6)
Female	501 (76.4)
Highest education level	
Secondary school	71 (10.8)
Diploma	129 (19.7)
Bachelor's degree and above	456 (69.5)
Marital status	
Single	134 (20.4)
Married	492 (75.0)
Widowed/divorced/ separated	30 (4.6)
Monthly household income (MYR)[a]	
B40 (< 4850)	165 (25.2)
M40 (4850-10959)	318 (48.5)
T20 (≥ 10960)	173 (26.4)
Occupation	
HCW	380 (57.9)
Non-HCW	276 (42.1)
Weight status	
BMI (kg/m²)[b]	
Underweight (< 18.5)	26 (4.0)
Normal weight (18.5 – 24.9)	276 (42.1)
Overweight (25 – 29.9)	208 (31.8)
Obese (≥ 30)	145 (22.1)
Health literacy	
Mean HL index[c] (± SD)	37.00 (±7.8)
HL categories[d]	
Limited (0-33)	184 (28.0%)
Sufficient (>33-42)	296 (45.1%)
Excellent (>42-50)	176 (26.8%)

[a]1 USD was equivalent to 4.7 Malaysian Ringgit (MYR)
[b]The total number of participants being assessed for BMI was 655 (missing data = 1)
[c]Assessed using formula index = (mean – 1)*(50/3)
[d]HL index categorised to three levels namely limited, sufficient and excellent

OFDS frequency and patterns

The prevalence of ever using OFDS was 95.1%. On average, the frequency of using OFDS was about seven times in the previous month (Table 2). Local food was the most frequently ordered type of food (50.3%), followed by fast food (22.3%) and international cuisine such as Korean, Mexican, Italian, Middle Eastern (15.1%). A total of 64.0% and 29.8% of the participants used OFDS to order food for lunch and dinner, respectively.

Only 10.7% of them ordered drinks along with meal every time, while 65.3% and 23.9% occasionally and never ordered drinks with meals, respectively. The most frequently ordered drinks were coffee (37.6%), fruit juices (22.3%) and carbonated drinks (15.3%). Most of them (92.3%) considered price as an important factor that needed to be taken into account when ordering food online. The average money spent per meal for each person was MYR 25.80 (approximately 5.50 USD). Only 37.8% of the participants considered food calories while ordering.

Table 2: Frequency and patterns of OFDS usage

Participants' OFDS Usage Frequency and Patterns	Total (n=614)[a] n (%)
Frequency of OFDS usage (in previous month) (mean ± SD)	7.2 (± 7.3)
Type of food/drink frequently ordered (n=596)[b]	
Fast food	133 (22.3)
Local food e.g., nasi lemak, roti canai, fried kuey teow, chicken rice etc.	300 (50.3)
International cuisine e.g., Korean, Mexican, Italian, Middle Eastern etc.	90 (15.1)
Healthy meals	30 (5.0)
Dessert	5 (0.8)
Drinks	36 (6.0)
Others	2 (0.3)
Type of meal frequently ordered	
Breakfast	21 (3.4)
Lunch	393 (64.0)
Dinner	183 (29.8)
Snack	17 (2.8)
Frequency of ordering drinks along with meals	
Every time	66 (10.7)
Sometimes	401 (65.3)
Never	147 (23.9)
Type of drink frequently ordered with meals (n=439)[c]	
Coffee	165 (37.6)
Tea	59 (13.4)
Fruit juice	98 (22.3)
Carbonated drink	67 (15.3)
Mineral water	21 (4.8)
Diet soda	11 (2.5)
Others	18 (4.1)
Calorie factor	
Yes	232 (37.8)
No	382 (62.2)
Pricing factor	
Yes	567 (92.3)
No	47 (7.7)
Money spent per meal per person (MYR) (mean ± SD)	25.8 (± 17.7)

[a]Total number of OFDS users after excluding 8 extreme outliers and 2 missing data (frequency of OFDS usage not provided).
[b]Total number of OFDS users after excluding incomplete data ((did not specify type of meal frequently ordered) (n = 18))
[c]Total number of OFDS users who order drinks along with meals after excluding those who never order drinks along with meals (n = 147), missing data (n = 21) and incomplete data ((did not specify type of drink frequently ordered) (n=7)).

Reasons using OFDS were time-saving (86.3%), effort-saving (72.1%) and convenience (68.7%) (Figure 1). Besides, promotions or discounts as well as a wide variety of food choices and restaurants were other reasons the participants ordered food via OFDS. Only 16.3% of the participants who considered the price of food ordered via OFDS to be reasonable. As for participants who chose "others", one of the more common reasons for using OFDS was to avoid crowds during the COVID-19 pandemic.

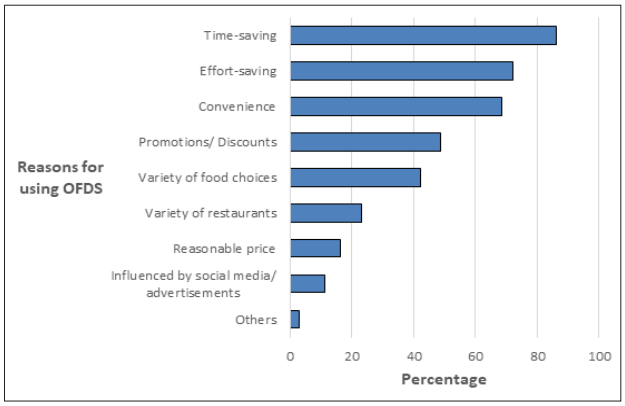

Figure 1: Reasons for using OFDS

Factors associated with frequent OFDS usage

In the bivariate analysis, age group, ethnicity, education level, monthly household income, occupation and mean HL index were significantly associated with frequent OFDS usage while gender, marital status and BMI were not significantly associated with frequent OFDS usage (Table 3).

However, in the multivariate analysis, age, ethnicity and monthly household income were significantly associated with frequent OFDS usage. Malay participants were more likely than non-Malays to be frequent OFDS users (aOR: 1.78; 95% CI: 1.16, 2.73). The younger the age group, the more likely they were a frequent OFDS user compared to the oldest age group (50 to 59 years). The adjusted odds ratio of being a frequent user was 17.2 times more for those who were between 20 to 29 years (aOR: 17.20; 95% CI: 5.76, 51.33), 6.2 times more among those aged 30 to 39 years (aOR: 6.15; 95% CI: 3.05, 12.37) and 3.3 times more among those 40 to 49 years old (aOR: 3.25; 95% CI: 1.60, 6.59). The odds of frequent OFDS usage among the high-income group (T20) were 2.7 times more compared to those from the low-income group (B40) (aOR: 2.71; 95% CI: 1.48, 4.97). Education level, occupation and mean HL index were not associated with frequent OFDS usage in the multivariable model.

Table 3: Factors associated with frequent OFDS usage

Variables	Frequent User (n = 352) n (%)	Non-frequent user (n = 262) n (%)	p value	Crude OR (95% CI)	*Adjusted OR (95% CI)
Age group					
20-29 years	26 (76.5)	8 (23.5)	<0.001	8.59 (3.15, 23.42)	17.20 (5.76, 51.33)
30-39 years	209 (63.3)	121 (36.7)		4.57 (2.37, 8.78)	6.15 (3.05, 12.37)
40-49 years	103 (51.8)	96 (48.2)		2.84 (1.44, 5.57)	3.25 (1.60, 6.59)
50-59 years	14 (27.5)	37 (72.5)		Reference	Reference
Ethnicity					
Malay	291 (59.4)	199 (40.6)	0.040	1.51 (1.02, 2.24)	1.78 (1.16, 2.73)
Non-Malay	61 (49.2)	63 (50.8)		Reference	Reference
Gender					
Male	75 (53.2)	66 (46.8)	0.258	Reference	
Female	277 (58.6)	196 (41.4)		1.24 (0.85, 1.82)	
Highest education level					
Secondary school	26 (41.3)	37 (58.7)	0.004	Reference	Reference
Diploma	62 (50.4)	61 (49.6)		1.45 (0.78, 2.67)	1.27 (0.66, 2.45)
Bachelor's degree and above	264 (61.7)	164 (38.3)		2.29 (1.34, 3.92)	1.30 (0.68, 2.48)
Marital status					
Single	78 (61.4)	49 (38.6)	0.401	1.72 (0.73, 4.08)	
Married	262 (56.7)	200 (43.3)		1.42 (0.63, 3.18)	
Widowed/ divorced/ separated	12 (48.0)	13 (52.0)		Reference	
Monthly household income (MYR)[a]					
B40 (< 4850)	76 (49.7)	77 (50.3)	0.014	Reference	Reference
M40 (4850-10959)	165 (56.5)	127 (43.5)		1.32 (0.89, 1.95)	1.56 (0.96, 2.52)
T20 (≥ 10960)	111 (65.7)	58 (34.3)		1.94 (1.24, 3.04)	2.71 (1.48, 4.97)
Occupation					
HCW	219 (61.7)	136 (38.3)	0.011	1.53 (1.10, 2.11)	1.22 (0.81, 1.84)
Non-HCW	133 (51.4)	126 (48.6)		Reference	Reference
BMI categories					
Under-Normal weight	170 (59.4)	116 (40.6)	0.345	1.17 (0.85, 1.61)	
Overweight-Obese	182 (55.7)	145 (44.3)		Reference	
Health literacy levels					
Mean HL index (±SD)	37.6 (±7.6)	36.3 (±7.4)	0.037	1.02 (1.00, 1.05)	1.01 (0.99, 1.04)
HL categories					
Limited (0-33)	89 (52.4)	81 (47.6)	0.292	Reference	
Sufficient (> 33-42)	165 (58.7)	116 (41.3)		1.30 (0.88, 1.90)	
Excellent (> 42-50)	98 (60.1)	65 (39.9)		1.37 (0.89, 2.12)	

*Adjusted for age group, ethnicity, gender, highest education level, marital status, monthly household income, occupation, BMI categories and HL levels

[a]B40 indicates low-income group; M40 indicates middle-income group; T20 indicates high-income group

Discussion

Malay ethnicity, younger age and high-income group (T20) were associated with frequent OFDS usage. Education levels, occupation, HL and overweight/obesity were not associated with frequency of OFDS usage. Research from UK and USA indicated that more time was allocated to home food preparation among the ethnic minority compared to the ethnic majority group (16). However, there were no local studies that explored the association between ethnicity and consumption of home-cooked food. Further research to look into this could be significant in understanding socio-demographic differences in food preparation and consumption which may affect perception of healthy eating practices.

As for the age and income factors, there is higher technology adoption and usage among the younger age group where majority of them own smartphones, leading to frequent OFDS usage compared to their older counterparts (18). This is similar to a study conducted in Pakistan which revealed individuals who were young and earned higher income were more tech-savvy, innovative and more positive towards the acceptance of new technology such as OFDS (19). Furthermore, low income is likely an impeding factor in using OFDS amidst the decades-high inflation which has affected many countries.

On the other hand, gender and marital status were not associated with individuals' willingness to buy food online. However, a study by Keeble et al. (16) reported that individuals who lived with children under 18 years old were more likely to use OFDS. This may be probably due to the time pressures faced by working parents especially if they have long working hours or erratic schedules which led them to look for other meal sources i.e., ordering food via OFDS platforms when preparing food at home is not an option (20). However, this factor was not explored in our study.

As this study was conducted during the COVID-19 pandemic, the frequency of OFDS usage among our participants was higher than studies conducted before the pandemic (1, 21). There was an increase of 65% for Asia Pacific region, 21% for North America, 23% for Europe and 150% for Latin America Region in OFDS usage. This new food purchasing behaviour adopted during pandemic will most likely remain as long-term behaviour (22).

Local foods such as *nasi lemak*, *roti canai* and fried *kuey teow* were the most frequent dishes ordered, followed by fast food. Another study conducted in Kuwait where majority of the participants were young adults reported that approximately three quarters of them chose fast food as the most preferred type of food ordered via OFDS (13). This could be attributed to age factor as fast food consumption among adults decreased with age (23). Meanwhile, healthy meals were one of the least popular choices among our participants which could be due to price factor. The price of healthier food options could be higher when purchased via OFDS (24). Another reason could be healthy food were perceived to be tasteless, bland and unappealing which is one of the identified barriers in healthy eating among Malaysians (25).

SSBs were also popularly ordered along with meals. This is worrying as SSBs is a major source of sugar and calories in our Malaysian diet and over-consumption of sugar will contribute to obesity and non-communicable diseases (NCDs) which are rising in trend (26).

Given that OFDS has the potential to affect health outcomes, comprehending the reasons of using OFDS from consumers' perspective can aid in more informed public health decision-making and intervention (27). As most of our participants were dealing with increased workload during the pandemic; time-saving, effort-saving and convenience were the top three reasons they used OFDS. The OFDS allowed them to avoid spending hours in preparing meals or travelling to the restaurants. Although most of them considered food price as an important factor before they made their food choice, they still used OFDS which is more expensive to trade for time. Similar results were reported by two other local studies (28, 29).

However, another study quoted to experience a variety of foods without visiting the restaurant physically as the main reason of using OFDS (30). Another popular reason for using OFDS is discounts and promotions such as free appetizers, free delivery and time-limited price-promotions. This often requires a minimum spend before the consumer is entitled to the promotions, potentially leading to over-ordering of food, overeating and excessive waste (24, 27). These may lead to negative public health implications for physical inactivity and obesity (24).

According to the WHO European Regional Obesity Report 2022, food and beverages purchased via OFDS were more energy-dense, high in fat, sugar and salt as well as large portion sizes, all of which could contribute to overweight or obesity (31). However, we did not find any significant association between overweight or obesity with frequent OFDS usage. This was in contrast with the study conducted by Dana et al. (1) where respondents who were overweight or obese were more likely to use OFDS. In another study conducted in U.K., participants with higher BMI and percent body fat were more inclined to consume takeaway and/or delivery meals (32).

HL plays an important role in improving health by promoting healthy eating behaviours as well as empowering them to be responsible for their own health. A systematic review by Buja et al. reported that HL was inversely associated with sugar intake (particularly in the form of SSBs) but not associated with salt and fat intake, which may be explained by the complex interplay of physiological and psychological factors (33). However, our study found no significant differences in HL levels between the frequent and non-frequent OFDS users. This is likely due to the two specific types of HL, namely nutrition literacy (NL) and food literacy (FL), which are the main elements in promotion and maintenance of healthy dietary behaviours were not

evaluated in this study. Currently, there are no NL and FL instruments that have been developed and adjusted to the characteristics of the Malaysian population. In addition, according to a systematic review and appraisal of NL and FL measurement tools, further research is required to address the gaps in developing well-defined, theoretically grounded measures which evaluate broader domains relevant to NL and FL (34).

Although this study did not find any significant association between overweight or obesity with frequent OFDS usage, OFDS may play an important role in increasing the accessibility of SSBs as well as energy-dense, nutrient-poor food, which in turn can cause increased NCD risk and health burden, if left unaddressed (31).

Therefore, the digital platforms should be regulated and monitored especially in areas of food and beverage marketing. Besides, analyses of policy measures on labelling requirements, display of nutritional information and health and nutrition claims should be conducted. This may hinder the consumers from choosing food based on the food pictures which are appealing in colours, fonts and graphics designed specifically to engage with the consumers (31, 35). Employers should offer subsidised healthy meals in the workplace cafeteria to promote healthy eating (36).

There are several limitations which need to be considered while interpreting the results. As this study only recruited participants from MOH where more than half of them were HCWs equipped with health-related knowledge, hence the findings were unable to represent all civil servants or the general working population in Malaysia. Moreover, as this is a cross-sectional study, the causal relationship between various factors with OFDS usage cannot be established. Although the recruited number of participants did not meet the calculated sample size, the calculated study power was approximately 80%. Other than that, the frequency of OFDS usage and body weight may be under-reported and the HL scores may be over-reported due to social desirability bias. However, this bias may be decreased by the use of online questionnaires which are anonymous, thereby allowing them to disclose sensitive information (16).

Our findings highlighted the patterns of OFDS usage and its associated factors among a group of workers. This study may be one of the few that targets on OFDS usage which is getting more widely used in our country. The findings particularly frequent OFDS usage among the younger age group could be used by policymakers as a guide in planning policies in OFDS and intervention programmes to tackle overweight and obesity starting at an early age considering that NCDs are the major contributor group of diseases in premature mortality burden (37).

Conclusion

OFDS usage was very common among our study population. Malay ethnicity, younger age groups and high-income group (T20) were associated with frequent OFDS usage. Education levels, occupation, HL and overweight/obesity were not associated with frequent OFDS usage. Future research should be extended with a wider spectrum of age groups and occupations, considering that this study only focused on civil servants who were of the age group up to retirement age of 60 years old to provide findings which could be generalised to the work population in general. Furthermore, the findings are useful to identify significant predictors whereby suitable intervention targeting specific group of individuals could be developed to improve nutritional quality in food and encourage healthy eating practices among the OFDS users.

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Competing interests

The authors declare that they have no competing interests.

Ethical Clearance

We obtained approval from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia, registered under NMRR ID-21-02160-S1R.

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Supplementary Table 1: Content validity of patterns of OFDS usage

			Questions						Answers					
			Relevance			Clarity			Completeness			Meaningfulness		
No.	**Items**	**No. of Experts**	**No. of ratings 3 or 4**	**I-CVI**	**k***	**No. of ratings 3 or 4**	**I-CVI**	**k***	**No. of ratings 3 or 4**	**I-CVI**	**k***	**No. of ratings 3 or 4**	**I-CVI**	**k***
1.	Frequency of OFD services usage in the past month	6	6	1	1	6	1	1	6	1	1	6	1	1
2.	Type of food frequently ordered	6	6	1	1	6	1	1	5	0.83	0.81	5	0.83	0.81
3.	Type of meal frequently ordered	6	6	1	1	6	1	1	5	0.83	0.81	5	0.83	0.81
4.	Frequency of ordering drinks along with food	6	6	1	1	6	1	1	5	0.83	0.81	5	0.83	0.81
5.	Type of drink frequently ordered	6	6	1	1	6	1	1	6	1	1	6	1	1
6.	Consideration of food calories when ordering food	6	5	0.83	0.81	5	0.83	0.81	5	0.83	0.81	5	0.83	0.81
7.	Consideration of pricing when ordering food	6	5	0.83	0.81	6	1	1	5	0.83	0.81	5	0.83	0.81
8.	Money spent per person per meal	6	6	1	1	6	1	1	6	1	1	6	1	1
	S-CVI/ Average			0.96			0.98			0.89			0.89	