

ORIGINAL ARTICLE

Impact of Pandemic COVID-19 towards Food Insecurity and Dietary Diversity Among B40 Mothers Living in Urban Areas in Selangor

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ABSTRACT

Introduction: Food security and dietary diversity are critical in ensuring the nutritional and dietary adequacy of mothers. However, since the COVID-19 outbreak, it has become more challenging for mothers to maintain a healthy and varied diet, as more households are reported to be food insecure. Thus, this study aimed to assess food insecurity and its determinants, as well as to determine how it relates to dietary diversity. **Methods:** A cross-sectional study comprising 200 of B40 mothers with children under the age of two who resided in metropolitan regions of Selangor was conducted. Household Food Insecurity Access Scale (HFIAS) and Minimum Dietary Diversity for Women (MDDW) questionnaires were used to measure food insecurity and dietary diversity, respectively. **Results:** About 67% of mothers experienced food insecurity and 29.5% experienced dietary monotony. Less than 12 years of education (AOR=4.89, 95% CI=1.87-12.83) and living in a family with six or more people (AOR=3.48, 95% CI=1.20-11.20) were significantly associated with food insecurity. Besides, mothers with a monotonous diet were eight times more likely to be food insecure (AOR=8.03, 95% CI=2.67-24.05). Higher odds of dietary monotony were associated with less than 12 years of education (AOR=2.46, 95% CI=1.13-5.35) and household income contributor of not more than one person (AOR=3.78, 95% CI=1.66-8.60). **Conclusion:** Food insecurity was associated with an increased chance of dietary monotony among low-socioeconomic women residing in urban community. Therefore, identifying and addressing issues related to poor dietary diversity may allow for preventive and proactive measures to improve their nutritional status and well-being.

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INTRODUCTION

The World Food Summit in 1996 defined food security as “having physical, social, and economic access to sufficient, safe, and nutritious food to meet dietary demands for a healthy and productive life at all times”. Conversely, the Food and Agriculture Organization (FAO) classified an individual as food insecure if they do not have consistent access to adequate nutritious and safe food for optimum growth and maintenance, as well as a fit and healthy lifestyle. Affecting both developing and developed nations, food insecurity has long been a global public health issue. With the recent outbreak

of COVID-19, however, this global health crisis has morphed into a global economic recession, threatening the health, employment, and income sources of millions of people worldwide, resulting in a huge increase in the number of individuals experiencing acute food insecurity throughout 2020-2021(1). According to a report by the United Nations on the State of Food Security and Nutrition in the World, in 2020, approximately between 720 and 811 million people worldwide experienced hunger.

According to the most recent The State of Food Security and Nutrition in the World (SOFI) data, 1.5 billion Asians suffering from food insecurity in 2021, and over one-third (795 million) were Africans, approximately 12% (268 million) were Latin Americans and the Caribbean, and with almost 4% (89 million) were in Northern Americans and Europeans (2). The scenario of food

insecurity in Asia, based on the reported data by SOFI, was comparatively better, where the cumulative reported incidence of moderate and severe food insecurity declined from 25.8% in 2020 to 24.6% in 2021(2). However, the incidence of severe food insecurity rose to 10.5%. In 2021, a guesstimated 37.5 million more individuals encountered severe food insecurity than in 2020. In comparison to 2019, 112.3 million more people were experiencing severe food insecurity.

Malaysia, without exception, has been severely impacted economically by COVID-19. Food insecurity is not a new public health concern, particularly among low-income households, but it has worsened since the COVID-19 outbreak. In a recent study that was conducted among low-income households residing in Klang Valley, during COVID-19 pandemic, the prevalence of food insecurity was significantly high, 59.1% (Hasmah, 2023-3). Low household income and higher expenditure on foods and drinks were the determinants of food insecurity and forced them to adopt few coping strategies such as spending on less expensive food.

According to the Malaysian Department of Statistics (DOSM), B40 is defined as bottom 40 % of Malaysian population with household income less than Ringgit Malaysia (RM) 4,850, meanwhile, M40 is defined as 40 % of Malaysians falls within Middle-income group with household income between RM 4,851 and RM 10,970 per month. DOSM also reported in Household Income Estimates (HIES) and Incidence of Poverty Report, up to 20% of M40 households have slipped into the B40 category (4). Aside from that, the proportion of poor households, the prevalence rate of absolute poverty, and the occurrence of hardcore poverty increased to 639.8 thousand households, 8.4%, and 1%, respectively, in 2020, from 405.4 thousand households, 5.6 %, and 0.4% in 2019 (3). Given the impact of COVID-19, Malaysia is ranking in the Global Food Security Index (GFSI) has dropped from 28th in 2019 to 39th in September 2021, however, it has managed to recover from 48th in 2020.

Food insecurity negatively impact the diversity and intake of diet. Food insecure households are more susceptible to have poor dietary diversity as a result of financial constraints that limit access to a diverse range of foods. Heightened incidence of inadequate dietary diversity due to household food insecurity increases the likelihood of malnourishment in both mother and child, which can have adverse health repercussions. According to Jomaa et al. (5), mothers from food-insecure households were more likely to suffer from dietary deficiencies and obesity, which may increase the risk of diet-related disease and contribute to negative nutritional and health outcomes for themselves and their children. Furthermore, food insecurity was suggested to be associated with double-burden malnutrition, either being underweight, overweight and obesity among women at reproductive age at a traditional fishing

village, Tuba Island, residing in Langkawi, Malaysia (6). Several studies also have shown an association between food insecurity and poor dietary diversity, particularly among groups who are vulnerable to malnutrition and require unique and special nutrient requirements, such as children, women of reproductive age, pregnant and breastfeeding mothers (7). As cited and stated by Chakona & Shackleton (7) when households encounter food insecurity, mothers lessen their own dietary intakes to ensure their children receive adequate nutrition to avoid malnutrition and women also rely on and choose less expensive high-energy foods with low nutrient content. Individuals who are extremely poor with financial insufficiency were forced to opt for less expensive and less nutritious food to prevent from being famished (8). Prolonged consumption of low nutrient but high energy diet leads to malnutrition such as obesity. Long-term consumption of a low-nutrient, high-energy diet results in malnutrition, such as obesity, which can later lead to other health complications such as hypertension, diabetes, and cardiovascular disease.

Maternal malnutrition resulted in negative effects on both foetus and childhood growth and development, but it is also linked to adverse maternal health outcomes and fatality. Women of reproductive age, including pregnant and lactating women, require an adequate, high-quality diet for their health and reproductive performance, as well as the health, survival, and development of their children, regardless of socioeconomic status. Physiological changes and adaptations during pregnancy and lactation significantly raise nutritional demands, including caloric and essential nutrient requirements. Meeting these demands during these stages is critical to maintaining mothers' nutritional status at the optimum level. Since people from low-income families are greatly affected by the economic recession caused by pandemic COVID-19, the likelihood of food insecurity is notable in this group; hence, the purpose of this study was to investigate the determinants of food insecurity among urban low-income population and to determine how it relates to dietary diversity.

MATERIALS AND METHODS

Study design and setting

This cross-sectional study recruited about 200 mothers from urban low-income households resided in Puncak Alam, Selangor from May to July 2022. Selangor was chosen as the second-highest rise in food and non-alcoholic beverage inflation among states in Malaysia (DOSM, 2021).

Study participants

The recruitment of participants was conducted with the help of community leaders in Puncak Alam residential. Due to restrictions of COVID-19 pandemic, the questionnaires were administered using Google forms survey and was distributed through online platform such

as WhatsApp and Telegram groups as well as Facebook pages. The inclusion criteria for participation were 1) women aged 18 to 49 years old, 2) have children under the age of two years old, 3) come from a B40 household with monthly household income of no more than RM4,850, and 4) have smart-phone and internet accessibility. The exclusion criteria were 1) illiterate and 2) live outside of urban areas. The respondents were informed on the background of the study and a consent form was obtained through agreement in the Google forms prior to the recruitment before they proceeded with answering the questionnaires.

Data collection and variables

Data was gathered using a structured questionnaire that the participants self-administered through Google forms survey.

Household food insecurity

The household food insecurity status was measured and assessed using the Household Food Insecurity Access Scale (HFIAS). The HFIAS consists of 9 occurrence questions that require participants to recall their experience with food insecurity over the previous 4 weeks (30 days) and incorporates "frequency-of-occurrence" questions (1 = rarely, 2 = occasionally, 3 = frequently). The total score from all nine frequency-of-occurrence questions ranges from 0 to 27, with a higher score indicating more food insecurity (access) experienced by the household. Following HFIAS guidelines, the accumulated HFIAS score is classified into four levels of household food insecurity: food secure and mild, moderate, and severe food insecure (9). Scores ranging from 0 to 1 indicate food secure; scores ranging from 2 to 7 indicate mild food insecurity; scores ranging from 8 to 11 indicate moderate food insecurity; and scores ranging from 12 to 27 indicate severe food insecurity (9). However, in this study, the three levels of food insecurity (mild, moderate, and severe) were combined to form a dichotomous variable (food secured and insecure) for analysis to identify determinants of food insecurity and determine its association with sociodemographic and dietary diversity.

Dietary diversity

The dietary diversity score (DDS) of mothers was measured and assessed using a food list method in accordance with the minimum dietary diversity for women guideline (MDD-W) (FAO, 2021). Dietary Diversity scores included the following ten food groups: (1) grains, roots, and tubers; (2) pulses; (3) nuts and seeds; (4) dairy; (5) meat, poultry, and fish; (6) eggs; (7) dark leafy greens and vegetables; (8) other vitamin A-rich fruits and vegetables; (9) other vegetables; and (10) other fruits. They were required for MDD-W, with the minimum DDS being zero if none of these ten food groups were consumed in the previous 24 hours and the maximum being ten if all ten food groups were consumed in the previous 24 hours. Food groups that

were consumed (yes) receive a one, while food groups that were not consumed (NO) receive a zero. By adding the number of food groups consumed, the final DD score was calculated. The MDD-W was used to divide the mothers into two groups: low dietary diversity and high dietary diversity, with the calculated score determining whether the participant was classified as high dietary diversity (consumption of five or more food groups) or low dietary diversity (consumption of five or fewer food groups) (consumption of fewer than five food groups). The higher the DDS, the more diverse the dietary intakes, implying higher nutrient uptake.

Sociodemographic variables

A self-administered questionnaire was used to collect information on socio-demographic characteristics about the participants, including age, ethnicity, education level, marital status, employment status, household income, household size, and the number of individuals who contribute to household income. The ages were categorised as follows: 18-28, 29-39, and 40-49 years old. Then, the ethnicity of the individuals was categorised as Malay, Chinese, Indian, or Others; however, for regression analysis, ethnicity was categorised as non-Malay or Malay. There were five educational levels: primary, secondary, certificate or diploma, bachelor's degree, and postgraduate, which were then categorised as having less than or greater than 12 years of education. In contrast, marital status and work status will be categorised using binary responses: single mother, not a single mother, and employed or unemployed. Income information is not necessary for analysis, but rather to assist in identifying participants from B40 households, as this study was focused on B40 mothers. Additionally, household size and the number of household income contributors were classified into two categories each: (1) fewer than six people and (2) six or more; and (1) only one person and (2) more than one person, respectively.

Data analysis

Data were processed and analysed using the IBM SPSS version 20 for statistical analysis. Descriptive analysis was used to present percentage and frequency. The Chi-square test was then used to determine the relationship between food insecurity and dietary diversity. Binary logistic regression was used to identify the determinants of food insecurity and low dietary diversity, after adjusted for age (years), maternal education status, maternal employment, and ethnicity. A p-value 0.05 and a 95% confidence interval were considered statistically significant (CI). Cronbach's alpha was used to evaluate the HFIAS's reliability, while the Kuder-Richardson 20 test was used to evaluate women's dietary diversity. Both the Household Food Insecurity Access Scale (HFIAS) and the Dietary Diversity Score (DDS) were found to be reliable (0.945 and 0.751).

Ethical consideration

Ethical approval was sought from UITM Research

Ethics Committee (REC) (Reference No: FERC/FSK/MR/2022/0079). The study procedure was explained to the participants before they agreed to participate in the study. Signed consent form was obtained from the participants prior to their recruitment. Data was kept confidentially.

RESULTS

Socio-demographic characteristics of the participants

Referring to Table I, about 52% (n=104) of mothers aged between 29 and 39 years old. Majority of them were Malay (72.5%, n=145), with the remainder being non-Malay (9.5%, n=19 Chinese; 12%, n=24 Indian; and 6.9%, n=12 others). About 92% (n=184) of respondents reported were married, 66.5 % (n=133) had more than 12 years of education and 52% (n=104), were employed. About 75% (n=156) of the respondents have a household of less than six people and 59 % (n=118) had only one person earning an income and 41% (n=82) had more than one person earning an income.

Prevalence of food insecurity and dietary diversity

About 33% (n=66) of the households were food secure, with significant numbers were food insecure; mild insecurity; 29.5% (n=59), moderate insecurity; 18.5% (n=37), and severe insecurity; 19% (n=38) (Table II).

Meanwhile, 141 out of 200 respondents (70.5%) consumed 5 or more food groups, indicating high dietary diversity, while 59 respondents (29.5%) consumed less than 5 food groups, indicating low dietary diversity (Table III).

Association between food insecurity and dietary monotony

Referring to Table III, the majority of respondents (41.0%, n=55) who consumed less than five food groups or low dietary diversity, were food insecure. About 93.9 % (n=62) of respondents who were food secure had high dietary diversity. The chi-square test analysis revealed a significant relationship between dietary diversity and household food insecurity, with a p-value of 0.001.

Determinants of food insecurity

Table IV depicted determinants of food insecurity in this studied population. After controlling for covariates, only years of education, household size, and dietary diversity remained statistically significant in multivariable logistic regression analysis. Those respondents with less than 12 years of education (AOR = 4.89, 95% CI = 1.87-12.83) were nearly 5 times more likely to be food insecure than those with more than 12 years of education. Household size with 6 people and above (AOR = 3.48, 95% CI = 1.08-11.20) were associated with 3.5 times higher odds of being food insecure than household size with fewer than 6 people. Respondents with lower dietary diversity were 8 times more likely to be food insecure than those with higher dietary diversity (AOR = 8.03, 95% CI =

Table I: Sociodemographic data of respondents (n=200)

Sociodemographic data	n (%)
Age	
18-28	65 (32.5)
29-39	104 (52.0)
40-49	31 (15.5)
Ethnicity	
Malay	145(72.5)
Chinese	19(9.5)
Indian	24(12.0)
Others	12(6.0)
Marital status	
Married	184 (92.0)
Single mother	16 (8.0)
Maternal education level	
Primary education	3 (1.5)
Secondary education	64 (32.0)
Certificate or diploma	80 (40.0)
Bachelor's degree	49 (24.5)
Postgraduate	4 (2.0)
Employment status	
Employed	80 (40.0)
Unemployed	96 (48.0)
Self-employed	24 (12.0)
Household size	
Fewer than 6	156 (78.0)
6 and above	44 (22.0)
Number of individuals contribute to household income	
Only one person	118 (59.0)
More than one person	82 (41.0)

Table II: Household food insecurity status of B40 mothers with children under the age of two living in Selangor's urban areas (n=200)

Food insecurity status	n (%)
Food secure	66 (33.0)
Mild food insecure	59 (29.5)
Moderate food insecure	37 (18.5)
Severe food insecure	38 (19.0)

Table III. Frequency of dietary diversity score by household food insecurity status (n=200)

Dietary diversity score	Food Insecurity			p-value
	Overall n (%)	Food secure (n=66, 33.0%) n (%)	Food insecure (n=134, 67.0%) n (%)	
Low dietary diversity (<5 food groups consumption)	59 (29.5)	4 (6.1)	55(41.0)	<0.001
High dietary diversity (≥5 food groups consumption)	141 (70.5)	62 (93.9)	79 (59.0)	

p-value from chi-square test. Significant value (p < 0.05)

Table IV. Unadjusted and adjusted odd ratios using logistic regression for factors associated with food insecurity among B40 mothers with children under the age of two living in urban areas in Selangor (n=200)

	Food insecurity			
	Unadjusted		Adjusted	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Age				
18-28	Ref.	Ref.	Ref.	Ref.
29-39	1.90 (1.00-3.62)	0.052	2.28 (1.05-4.94)	0.059
40-49	3.36 (1.22-9.28)	0.020	1.94 (0.55-6.83)	0.300
Ethnicity				
Malay	Ref.	Ref.	Ref.	Ref.
Non-Malay	1.28 (0.65-2.52)	0.470	1.34 (0.59-3.05)	0.486
Marital status				
Married	Ref.	Ref.	Ref.	Ref.
Single mother	2.26 (0.62-8.21)	0.217	1.95 (0.38-10.12)	0.426
Years of education				
Less and equals to 12 years	8.36 (3.38-20.67)	<0.001	4.89 (1.87-12.83)	0.001
More than 12 years	Ref.	Ref.	Ref.	Ref.
Employment status				
Employed	Ref.	Ref.	Ref.	Ref.
Unemployed	1.53 (0.85-2.78)	0.160	1.04 (0.33-3.32)	0.950
Household size				
Fewer than 6	Ref.	Ref.	Ref.	Ref.
6 and above	6.60 (2.25-19.4)	0.001	3.48 (1.08-11.20)	0.037
Number of individuals contribute to household income				
One person	1.74 (0.96-3.15)	0.071	0.92 (0.29-2.91)	0.883
More than one person	Ref.	Ref.	Ref.	Ref.
Dietary diversity				
High	Ref.	Ref.	Ref.	Ref.
Low	10.79 (3.71-31.40)	<0.001	8.03 (2.67-24.18)	<0.001

Significant odds ratios are bolded (p<0.05); OR: Odds Ratio; CI: Confidence Interval

2.67-24.18).

Factors associated with dietary monotony

According to the unadjusted analyses as shown in Table V, respondents' years of education, employment status, household size, number of individuals contributing to household income, and food insecurity were all significantly associated with low dietary diversity. In multivariable logistic regression, respondents with less than 12 years of education were 2.5 times more likely to have dietary monotony than those with more than 12 years of education (AOR = 2.46, 95% CI = 1.13-5.35). Furthermore, the number of people who contribute to the household income of not more than one person was associated with a nearly fourfold increase in the likelihood of having dietary monotony (AOR = 3.78, 95% CI = 1.66-8.60). Food insecurity status (mild food insecurity AOR = 10.46, 95% CI = 3.23-33.93 and moderate food insecurity AOR = 16.27, 95% CI = 4.59-57.70) was associated with higher odds of dietary monotony.

DISCUSSION

The recent COVID-19 outbreak has not only caused

major chaos and backlogs in the health care system, but it has also impacted billions of people globally in terms of food security due to the massive economic damage caused by COVID-19. In response to concerns about COVID-19's effects on food and nutrition security, this present study is conducted to investigate the status and factors associated with food insecurity, as well as low dietary diversity, among mothers from low-income families (B40) who have children under the age of two and live in urban areas in Selangor.

Food insecurity is a common issue among low-income households, especially in developing countries such as Malaysia (10). In this present study, food insecurity is found to be prevalent among mothers from low-income families (B40). Relatively similar studies conducted among lactating mothers and women of reproductive age in Nepal also reported high food insecurity at a rate of more than 50% (11,12). Food insecurity was also reported to be high in a study that assessed the occurrences of food insecurity at the household level in urban and semi-urban areas during the pandemic COVID-19 (13). Given Selangor's increased poverty rate, decreased monthly household gross income, and Malaysia's economic crisis caused by the COVID-19

Table V: Unadjusted and adjusted odds ratios using logistic regression for factors associated with low dietary diversity among B40 mothers with children under the age of two who live in urban areas in Selangor (n=200)

	Low Dietary Diversity			
	Unadjusted		Adjusted	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Age, years				
18-28	Ref.	Ref.	Ref.	Ref.
29-39	0.79 (0.40-1.57)	0.498	0.61 (0.25-1.49)	0.280
40-49	1.42 (0.58-3.48)	0.441	0.90 (0.27-3.04)	0.867
Ethnicity				
Malay	1.72 (0.83-3.56)	0.145	1.22 (0.48-3.10)	0.682
Non-Malay	Ref.	Ref.	Ref.	Ref.
Marital status				
Married	Ref.	Ref.	Ref.	Ref.
Single mother	1.09 (0.36-3.30)	0.873	0.83 (0.17-3.98)	0.82
Years of education				
Less and equals to 12 years	3.59 (1.90-6.80)	<0.001	2.46 (1.13-5.35)	0.023
More than 12 years	Ref.	Ref.	Ref.	Ref.
Employment status				
Employed	Ref.	Ref.	Ref.	Ref.
Unemployed	3.20 (1.68-6.07)	<0.001	0.93 (0.29-0.294)	0.895
Household size				
Fewer than 6	Ref.	Ref.	Ref.	Ref.
6 and above	2.50 (1.25-5.01)	0.010	1.07 (0.39-2.91)	0.901
Number of individuals contribute to household income				
Not more than one person	4.43 (2.13-9.22)	<0.001	3.78 (1.66-8.60)	0.002
More than one person	Ref.	Ref.	Ref.	Ref.
Food Insecurity				
Food secure	Ref.	Ref.	Ref.	Ref.
Mild food insecurity	13.08 (4.21-40.62)	<0.001	10.46 (3.23-33.93)	<0.001
Moderate food insecurity	20.34 (6.11-67.69)	<0.001	16.27 (4.59-57.70)	<0.001
Severe food insecurity	3.50 (0.95-12.87)	0.059	2.17 (0.54-8.71)	0.273

Significant odds ratios are bolded (p<0.05); OR: Odds Ratio; CI: Confidence Interval

pandemic, the high prevalence of food insecurity observed in this study was anticipated (4). Moreover, participants in this study were urban mothers, which influences food insecurity because urban inhabitants are more likely to experience it. According to Wertheim-Heck et al. (14) food and nutrition insecurity is widely recognised among metropolitan Asia’s low-income populations. During the COVID-19 pandemic, highly populated, economically challenged metropolitan areas were impacted the hardest (15).

Consuming more than four food groups or items suggests appropriate dietary diversity for mothers and women of reproductive age due to physiological needs that entail extra and particular requirements to maintain the mother and their offspring optimum health. In this study, majority (70.5%) of the mothers had good dietary diversity which coincides with the research findings of Tamale & Kagoro-Rugunda (16) that reported a high prevalence of women that had adequate dietary diversity. However, this contradicts studies conducted in Nepal (11) and other countries (17-20) that found a low incidence of adequate dietary

diversity. In addition, a study by Weerasekara et al. (21) discovered that a disproportionately higher percentage of women, particularly in urban areas, did not meet the Minimum Dietary Diversity for Women (MDD-W). The study location could explain the disparity between studies, as those studies were mostly conducted in low- and lower-middle-income countries, as opposed to Malaysia, which is in the upper-middle income bracket. According to the findings of Jordan et al. (22) more urban households have a higher Women’s Dietary Diversity Scores (WDDS) than rural households do on average. Compared to rural areas, urban areas typically have a wider variety and greater availability of nutrient-dense foods to choose from. Partly because urban consumers have higher average incomes, creating a greater demand for perishable goods. However, this advantage does not benefit the low-socioeconomic population residing in this urban area. They have limited access to quality food and experience unequal barriers to healthy nutritious food and have higher risk of malnutrition (23).

Food insecurity restricts diet variety. Diets rich in nutrient-dense foods, such as fresh fruits and vegetables,

tubers, and legumes, are inaccessible to individuals with lower incomes. Due to economical constraints, households may opt for a diet consisting primarily of staples. In situations where there is insufficient access to food, foods of a higher quality and/or lower calorie density, such as fruits and vegetables and leaner sources of protein, are frequently substituted for lower-cost per-calorie energy-dense foods that are frequently high in simple carbohydrates and fat. The findings reported a significant association between food security and dietary diversity indicating that mothers with low dietary diversity were found eight times more likely to be food insecure than those with high dietary. This study is underpinned by a Nepalese survey that discovered a strong relationship between food insecurity and dietary monotony (11). Further to that, research by Getacher L and colleagues in Ethiopia, also revealed a positive association of household food insecurity and poor dietary practises (24). The decrease in maternal dietary diversity was primarily attributable to reductions in all types of foods derived from animals. Women living in households with the highest levels of food insecurity were consistently and significantly less likely to report consuming foods derived from animals compared to women living in households with adequate food supplies. To put it another way, food security encourages individuals to consume a sufficient quantity and quality of food, which contributes to a higher minimum dietary diversity score and improved nutritional status. It was believed that a food secured woman, will focus to practice dietary diversity in her diet, and promptly implemented it (17).

Analysis of this study suggested that the number of individuals contributing to the household was significantly associated with dietary diversity. It was found that mothers who came from households in which only one person contributed to the household income were more likely to fall short of the minimum requirements for dietary diversity. This is primarily attributable to the fact that when more people contribute to the household income, more funds are available, allowing for the purchase of a wider variety of foods. According to Aggeli et al. (25), when only one family member contributes to the household's income, the risk of food insecurity increases. This makes it more challenging to meet the minimum dietary diversity requirements especially during the unprecedented uncertainty of COVID-19, more people are vulnerable to food insecurity. People from low-income households who were already vulnerable to food insecurity prior to the emergence of COVID-19 are particularly hard hit. The economic constraints imposed by COVID-19 contribute significantly in reducing access to sufficient and nutritious food.

In this study, education was found to be a protective factor against dietary monotony, with most mothers with over 12 years of education, meeting the minimum

dietary diversity requirements. Moreover, it is one of the factors that determine food insecurity. Mothers with less than 12 years of education were about five times more likely to experience food insecurity than those with more than 12 years of education. A previous study in Nepal discovered that educated women have a significantly lower risk of food insecurity than low educated women (12). In fact, low levels of maternal education are associated with lower levels of nutrition knowledge, which may affect household food insecurity (FI) due to an inability or reduced ability to manage food resources (25). Besides, educated women may have more employment opportunities, income, and purchasing power, which can help sustain household food security and therefore increase their consumption of a variety of foods. Similar observations on the effect of education on dietary diversity were also made in studies done in Kenya (26,27). This could be attributed to the role of education in informing people about the importance of eating a diverse diet.

In terms of the relationship between household size and food insecurity status, this study presented findings that corroborate the results of other studies that investigated relatively similar factors (28,29). Mothers from households with fewer than six members were less likely to be food insecure than their counterparts. The observed relationship between household size and food insecurity may be due to the fact that during the COVID-19 outbreak, food supply was disrupted, food prices rose, and more people lost their jobs, limiting the budget for food. With larger households, the amount of food consumed per household had to be limited. Furthermore, large family size increases the burden of food consumption. It is expected to have a greater need for food acquisition, making a household more likely to experience food insecurity than a smaller family size, particularly in low-income households. To give a brief, food insecurity rises with the number of family members and vice versa.

The strength of this study is, it was conducted focusing on pairs of mother and child aged less than two years old from low-socioeconomic households. To the best of our knowledge, this was the only study that was conducted in Malaysia targeting this disadvantaged population residing in urban area. This study provides an insight on the influence of dietary diversity towards food security status, and therefore, will shed some lights in the future, on how these two inter-related factors might interfere with the feeding practices and development among the affected children. However, this present study has some drawbacks. First, the cross-sectional study design prevents causal inferences between food insecurity and dietary diversity outcomes and their antecedents. Next, the measure of dietary diversity was based solely on 24-hour food consumption and the food list technique, making it susceptible to typical day-to-day variation, and it did not account for the amounts of food consumed.

CONCLUSION

This study concluded that food insecurity was frequent in low-income household, although majority of mothers met the minimum dietary diversity requirements for women. It was discovered that food insecurity related to an increased chance of dietary monotony. Mothers with less nutritional diversity were eight times more likely to be food insecure than those with a greater variety of foods. This study identified education level and household size as factors influencing food insecurity. Subsequently, years of education and the number of household income contributors were factors associated with dietary monotony. It is recommended to policy makers to design nutritional interventions which incorporates knowledge assimilation in improving the studied population's nutritional status such as on selection of nutritious food from readily available and affordable food sources. Future study should include analysing food insecurity on an individual level and incorporate additional variables such as spouse's employment status, food and/or financial assistance received, women empowerment, household head, food taboos, nutritional literacy and wealth status. Identifying and addressing issues related to poor maternal dietary diversity are essential to allow for preventative and proactive measures in this population.

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