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Association of Household Food Security Status and Dietary Diversity among Children during COVID-19

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ABSTRACT

The aim of this study is to identify food security status and its association with dietary diversity among children from low-income households (B40) during COVID-19. A cross-sectional study was conducted among 174 mothers and their children (<2 years old) residing in Selangor urban area. The data collection was collected through sociodemographic questionnaire to assess maternal and children's sociodemographic characteristics, Household Food Insecurity Scale (HFIAS) to assess household food insecurity status, and Minimum Dietary Diversity (MDD)-Children 6–23 months to assess dietary diversity score for children. The data was analyzed descriptively and a Chi-square test was used to find the relationship between food insecurity and dietary diversity. Findings showed that 105 participants (62.6%) was food insecure, there was 52.9% had low dietary diversity. There was no association between food insecure and dietary variety among B40 mothers living in urban area in Selangor. However, this study found that maternal education level (p=0.006), years of education (p=0.014) and the number of household income recipient (p=0.018) are significantly associated with the food insecurity. This study has provided the prevalence of food insecurity among B40 living in urban area and it is suggested that further research involving diverse household income of participants and research areas should be done to provide better insights on food insecurity and dietary diversity among children in Malaysia.

Keywords: children, dietary diversity, food insecurity, household food insecurity access scale

INTRODUCTION

Food security in general is the availability of food and people's capacity to obtain it. According to the Food and Agriculture Organization (FAO), food security is described by the World Food Summit in 1996 as having physical, social, and economic access to adequate, safe, and nutritious food that always satisfy people's food choices and dietary needs for an active and healthy life (FAO 2021). An individual is in a food crisis if none of the conditions stated by the FOA in its food security definition are fulfilled. The COVID-19 pandemic has exacerbated existing challenges in global food security. Factors such as conflict, socioeconomic conditions, natural disasters, climate change, and pests were already contributing to increasing food crises before the pandemic. However, the pandemic has further jeopardized the health, employment, and incomes of millions, leading to a significant rise in acute food insecurity from 2020 to 2021 (Khan & Ali 2023).

An estimated 9.76 million (30%) of the Malaysian population is expected to suffer from food insecurity due to COVID-19. According to the Department of Statistics Malaysia (DOSM), the unemployment rate has dramatically increased to 3.9 percent in March for the year 2020, affecting a total of 546.6 thousand workers in Malaysia (DOSM 2020). According to the Household Income Estimates (HIES) and the DOSM's Poverty Report, up to 20 percent of Middle Income (M40) households slipped into the B40 category during the pandemic (Palansamy 2021). The migration of households from M40 to B40 signifies a decline in overall household income. This downward economic shift directly

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impacts a family's financial capacity to afford an adequate and nutritious diet for their children. This poses a direct threat to children's well-being, as they may face an increased risk of malnutrition and deficiencies if their diets lack essential nutrients (Pachter *et al.* 2020). The COVID-19 pandemic has significantly impacted the food consumption of urban low-income families, with 53% reducing their intake due to affordability concerns (UNICEF 2020).

Dietary diversity is associated with food insecurity in various contexts. Household food insecurity during COVID-19 was significantly correlated with children's dietary diversity, suggesting that food insecurity may worsen the diversity of young children's food consumption (Suryana *et al.* 2023). Children from food insecure households were more likely to be malnourished, and dietary diversity partially mediated this association (Hassan *et al.* 2022). Low food availability and quality were negatively associated with the implementation and maintenance of minimum dietary diversity in infants, highlighting the importance of food security for infant feeding (Koyratty *et al.* 2022). Thus, the purpose of this study is to assess food security status and identify the association between household food security status during pandemic COVID-19 with dietary diversity among children from low-income households.

METHODS

Design, location, and time

This cross-sectional study was conducted from March to June in year 2022. The cross-sectional study design was chosen because the collection data was conducted in specific point of time, which is during COVID-19 pandemic and to explore the association of the COVID-19 on food insecurity and dietary diversity (Olsen & St George 2004). Purposive sampling was employed to recruit 174 B40 mothers and their children less than two years old residing in the urban area of Selangor.

The recruitment process was done by requesting the participant to fill in the informed consent form and the socio-demographic part of the questionnaire. A thorough screening process was done to identify whether the participant household income was in the range of B40 before proceeding to the other part of the questionnaire. This study has obtained its ethical approval by UiTM Research Ethics Committee (FERC/FSK/MR/2022/0079).

Sampling

Participants for the study were recruited through online and in-person methods. The inclusion criteria specified mothers aged 18 to 49, children aged 6 to 23 months, both in good health, residing in Selangor, and belonging to a B40 household (with an income below RM4,850). The age range of the mother likely corresponds to the reproductive age of women and is relevant for assessing maternal and child health. On the other hand, the age range for a child is chosen as it is critical for assessing early childhood health and nutritional practices. Mothers-child with underlying medical conditions who live outside the research area were the exclusion criteria. The study procedure was explained in detail and the paper containing information of the study will be distributed to the participants before receiving their consent if they agree to participate.

Data collection

The data was collected through a structured questionnaire consisting of four sections; 1) mother's sociodemographic information on mother's characteristics which include age, ethnicity, education level, marital status, employment status, household income, 2) Household Food Insecurity Access Scale (HFIAS), which ascertains the household's status on food insecurity, 3) Children information on children's age and gender, 4) Minimum Dietary Diversity- Children 6–23 months to assess micronutrient sufficiency by measuring the dietary diversity of children.

Household food insecurity. The household food security status was measured and assessed using the Household Food Insecurity Access Scale. It is a valid tool developed by the USAID-funded Food and Nutrition Technical Assistance II project (FANTA) in collaboration with Tufts and Cornell Universities, among other partners. HFIAS is a validated tool, with the Cronbach's Alpha of 0.926 (Hussein *et al.* 2018), is used to measure the level of household food insecurity. The HFIAS comprises 9 questions prompting participants to recall food insecurity experiences over the past four weeks, including "frequency-of-occurrence" responses (1=Rarely,

2=Occasionally, 3=Frequently). The total score, ranging from 0 to 27 based on nine frequency-of-occurrence questions, indicates the level of food insecurity or limited access, with a higher score reflecting greater household food insecurity (Coates *et al.* 2007).

Dietary diversity. The Minimum Dietary Diversity (MDD), which was created from the WHO's Infant and Young Children Feeding Guidelines (IYCF) published in Indicators for assessing infant and young child feeding practices: definitions and measurement methods (WHO 2021), was used to calculate the Dietary Diversity Score (DDS) of children under the age of two. The data on the children's food and liquid intake the day prior is gathered. Eight major food groups are divided into the following categories: 1) grains, roots, and tubers; 2) legumes and nuts; 3) flesh foods; 4) eggs; 5) fruits and vegetables high in vitamin A; 6) dairy products; 7) other fruits and vegetables; 8) and breast milk.

Data analysis

The data collected were transferred to SPSS 26 for statistical analysis. Prior to the process of statistical analysis, frequencies for non-continuous data and mean values for continuous data was obtained and utilized to check for outliers. The mean, standard deviation, frequency, and percentage were used to present descriptive results. A Chi-square test was used to find the correlation between food insecurity and socio-demographic characteristics as well as the relationship between food insecurity and dietary diversity. Due to smaller sample size achieved in this study, chi-square test was used instead of binary logistic regression to identify the determinants of food insecurity.

RESULTS AND DISCUSSION

A total of 174 data are collected from this study. Table 1 illustrates the sociodemographic characteristics of the household with children aged 6 to 23 months old. About 98.9 % were married, and another 1.1% were single mothers. In terms of employment status, the majority of mothers 59.8% are employed, while 25.9% were unemployed and 14.4% were self-employed. About 87.9% have more than 12 years of education. A total of 88.5% have a household size of one to five persons, 9.8% with a household size of six to nine, and the remaining 1.7% have a household size of 9 and above. Most households receive income from more than one person 60.3%, followed by households with just one person receiving income 38.5% and households with none receiving income 1.1%.

Prevalence of household food security status

The majority of households 42.5% are experiencing mild food insecurity, followed by 37.4% being food secure, 12.6% being moderately food insecure, and 7.5% experiencing severe food insecurity. In this study, the three levels of food insecurity (mild, moderate, and severe) were grouped to form a dichotomous variable (food secured and insecure) to analyze the prevalence (Table 2). There are potential limitations when the dichotomous variable is applied, for example the loss of nuance provided by distinguishing between mild, moderate, and severe food insecurity and the loss of statistical power as information about the degree of food insecurity is not fully utilized. However, by performing dichotomous variable, the result will be much easier for interpretation and communication to people who were not involved in conducting this study. The data revealed that 62.6% of the study population is food insecure (mild, moderate, and severe), while the remaining 37.4% are food secure.

This study revealed that the prevalence of food insecurity among the studied population was found to be 62.6%, which households experiencing mild food insecurity accounting for the majority of this. It is quite similar to a study in Indonesia by Syafiq *et al.* (2022), where it was reported that a total of 65% of respondents had food insecurity during the COVID-19 pandemic. Previous studies in various other countries also showed relatively consistent prevalence, such as in California, a higher prevalence of food insecurity was reported during the COVID-19 pandemic situation (Adams *et al.* 2020). In a local setting, the prevalence of food insecurity during the COVID-19 pandemic, especially among low-income families, remains scarce to this date. Food insecurity prevalence during the COVID-19 home confinement in Malaysia was found to be 43.2% (Tan *et al.* 2022). Additionally, 21.4% of undergraduate students reported experiencing food insecurity during COVID-19 (Elias *et al.* 2023).

Table 1. Sociodemographic characteristics of households with children aged 6–23 months living in the city of Selangor

Characteristics	Total data (n=174)
	n (%)
Children's characteristics	
Gender	
Male	89 (51.1)
Female	85 (48.9)
Age (Months) (Mean±SD)	14.6±5.5
6–11	57 (32.8)
12–17	61 (35.1)
18–23	56 (32.2)
Mother's characteristic	
Age (Years) (Mean±SD)	29.6±4.2
18–28	70 (40.2)
29–39	100 (57.5)
40–49	4 (2.3)
Race	
Malay	165 (94.8)
Chinese	2 (1.1)
Indian	7 (4.0)
Others	0 (0.0)
Marital status	
Married	172 (98.9)
Single mother	2 (1.1)
Employment status	
Employed	104 (59.8)
Unemployed	45 (25.9)
Self-employed	25 (14.4)
Education level	
Primary education	3 (1.7)
Secondary education	18 (10.3)
Certificate diploma	73 (42.0)
Bachelor's degree	72 (41.4)
Postgraduate degree	8 (4.6)
Years of education	
<12 Years	21 (12.1)
>12 Years	153 (87.9)
Household characteristics	
Household size	
1–5	154 (88.5)
6–8	17 (9.8)
9 and above	3 (1.7)
The number of household income recipients	
None	2 (1.1)
Only one person	67 (38.5)
More than one person	105 (60.3)

Table 2. Descriptive analysis of household food security status

Food security status (n=174)	n (%)
Food secure	65 (37.4)
Mildly food insecure	74 (42.5)
Moderately food insecure	22 (12.6)
Severely food insecure	13 (7.5)

The high prevalence obtained from this study was expected, especially when taking into note that the study population is among low-income families living in an urban area. For a metropolitan area like Klang Valley, a combination of factors such as increasing food prices, persistent chronic poverty, and market-based supply could threaten household food security (Birhane 2014). The early stages of the COVID-19 situation revealed that the urban population faced difficult food supply conditions. Accessing food was highly challenging, especially for this urban population, due to the movement restriction, physical distancing, and closure of markets during the pandemic. Not only that but the high degree of food insecurity reported in this study may be related to the rising food inflation over the past two years of the pandemic. Households, especially low-income households living in the city, struggled to cope with the situation to continue providing food daily. Also proven by a previous study, low-income families in urban areas, as affected by the Covid-19 crisis, may alter their spending on food due to reduced income (UNICEF 2020). Additionally, it was shown that Malaysian people generally reduced the number of their meals and skipped primary meals at least once or twice a year owing to financial constraints.

In Malaysia, the percentage of low-income urban families experiencing food insecurity is more remarkable, at 65.7% (Shariff & Ang 2001), than in rural low-income households (58%). Nonetheless, the proportion of low-income urban households encountering child hunger (27.8% and 27.1%, respectively) is lower than that of rural households (34.5%). There are disparities in family food security between urban low-income households and rural households (Shariff & Khor 2008). The two factors that can explain these disparities are the cost of living and unexpected costs. Urban low-income households face a higher cost of living compared to rural households. Despite having fixed incomes, the cost of living in urban areas is more remarkable, which means a significant portion of their income is spent on necessities such as housing, transportation, and utilities. This condition leaves them with less disposable income to spend on food, making it more challenging to maintain food security.

Association between household food security status and dietary diversity children

Table 3 shows a p-value of 0.436 for the association between household food insecurity and dietary diversity, indicating no significant relationship between food insecurity and dietary diversity among children aged 6–23 months living in the city during the COVID-19 pandemic. The majority (31.6%) of children with low dietary diversity were experiencing food insecurity.

On the other hand, there were 54 children (31.0%) who maintained high dietary diversity even though their households faced food insecurity. This may be attributted to the presence of other factors or coping mechanisms at the household level which could buffer the direct

Table 3. Association between household food insecurity and dietary diversity children

Characteristics (n=174)	Dietary diversity		
	High n (%)	Low n (%)	*p*
Food insecurity status			0.436
Food secure	28 (16.1)	54 (31.0)	
Food insecure	37 (21.3)	55 (31.6)	

*Chi-square test

impact of food insecurity on children's dietary patterns. In addition, the reuslts highlight the complexity of the relationship between household economic conditions, food access and actual dietary practices during the pandemic situtation.

Determinants of food insecurity

Table 4 yields the determinants of food insecurity among B40 communities living in the urban area of Selangor. Findings revealed that food insecurity status was significantly correlated with the mother's education level, the mother's years of education, and the number of household income recipients, with a p-value of 0.006, 0.014, and 0.018, respectively.

The majority of the mother with higher education levels (>12 years) were experienced food security and mildly food insecure only. The majority (35.1%) of the households receiving income from more than one person were food insecure. The findings also provide a statistical association between household food insecurity with sociodemographic characteristics such as maternal education and household food insecurity with significant values (p=0.006) and (p=0.014), respectively. The data revealed that the majority of mothers (87.9%) have at least secondary education and above. This finding may explain why most of them were experiencing food security and were mildly food insecure only.

Meanwhile, a higher proportion was found in moderately food insecure and severely food insecure among mothers with less than 12 years of education. The possible explanation for this might be related to the mother's knowledge in terms of preparing the food for the families. Educated mothers are best believed to be more aware of the importance of nutrition and health care. It was

Table 4. Determinants of food insecurity

Characteristics	Total data (n=174)		
	Food secure n (%)	Food insecure n (%)	*p*
Education level			0.006*
Primary education	1 (0.6)	2 (1.1)	
Secondary education	3 (1.7)	15 (8.6)	
Certificate or diploma	21 (12.1)	52 (29.9)	
Bachelor's degree	38 (21.8)	34 (19.5)	
Postgraduate degree	2 (1.1)	6 (3.4)	
Years of education			0.014*
<12 years	4 (2.3)	17 (9.8)	
>12 years	61 (35.1)	92 (52.9)	
Number of household income recipients			0.018*
None	0 (0.0)	2 (1.1)	
Only one person	21 (12.1)	46 (26.4)	
More than one person	44 (25.2)	61 (35.1)	

*Chi-square test, significant value p<0.05

also found that there was an association between maternal education level with lower diet quality and less healthy food choices (Iftikhar 2017).

Although the majority (60.3%) of the households in this study were receiving income from more than one person, they still fall under the B40 category, whose income ranges below RM4,850, and they are experiencing food insecurity, according to the data. Although with more than one person having income in a household, the high living cost such as housing, healthcare, and education expenses can absorb a significant portion of the household income (Hao 2022). This in turn leaves less money available for purchasing sufficient nutritious food. Apart from that, households with multiple earners may also be burdened by debt, including loans, credit card debt, or medical bills. Servicing these debts can reduce the available income for purchasing food and thus contributing to food insecurity (Kittiprapas 2022).

It can be assumed that financial issues contribute to the higher proportion of food insecurity among these B40 communities, especially with the current COVID-19 situation. Households with low monthly income tend to have lesser purchasing power, contributing to the insufficient food supply. Several studies in developing and developed nations have indicated that family income is an essential determinant of household food insecurity (Grimaccia *et al.* 2018; Abdullah *et al.* 2017; Loopstra *et al.* 2013). Inadequate income can contribute to the failure of impoverished households to provide appropriate meals for their members.

Inadequate dietary intake and family food insecurity are acknowledged as having major effects on child undernutrition in UNICEF's conceptual framework for nutrition. It was found that children's minimum diet diversity in Bangladesh, Ethiopia, and Vietnam was strongly correlated with household food security (Ali *et al.* 2013). In these three countries, the percentage of children who had reached minimal dietary diversity was highly related to the HFI category, where the greater family's food insecurity, the less probable that children achieved the minimum dietary diversity (Ali *et al.* 2013). Children from low socio-economic status were also experiencing non-diversified food intake and low diet quality (Salleh *et al.* 2021). Parents from low-income families may need help conducting optimal child-feeding practices due to inadequate means to give their children a diverse diet with enough nutritional meals. Different demographic studies have also found that households with higher incomes and resources tend to have more diversified diets and a lower incidence of child undernutrition.

In contrast to this study's findings, household food insecurity was not associated with dietary diversity among children aged 6–23 months in the urban area of Selangor during COVID-19. A possible explanation for this is the study location of the previous study being compared among poor countries with lower income status, which are Bangladesh, Ethiopia, and Vietnam. Malaysia is classified as an upper middle-income country, which might explain the study results. Considering that this study was conducted in an urban area of Selangor, the level of food insecurity reported in the households might get biased since the living cost in both areas is different. People living in urban areas may consider themselves food insecure, however, if they live in a rural area with their monthly income, they may not be considered food insecure.

Besides, as found in this study, maternal education and the number of household income recipients strongly associated with food insecurity, similar to dietary diversity. A mother's nutrition knowledge may cause her to prioritize her children in providing nutritious and adequate foods. They may be in the food insecure category, but in terms of their children's daily intakes, they try to provide food sufficiently. Mothers may also cut back on their intake to provide the basic needs of their young children and babies. Additionally, the data collection method, which is the food-recall list used in this study, may induce biased results as the mother may over-report or under-report some foods the children consume.

Moreover, this method requires a trained interviewer to conduct. Apart from that, this study’s heterogeneous sampling may also influence the negative association between food insecurity and children's dietary diversity during COVID-19. In addition, time constraints in conducting this study could also be the reasons for the results where the sample size is insufficient to see a clear difference between household food insecurity and dietary diversity.

CONCLUSION

This study highlighted that most B40 households living in the city of Selangor experienced mild food insecurity during the Covid- 19 pandemic. In this research study, maternal education level and the number of household income recipients are identified as determinants of food insecurity. Since the COVID-19 pandemic may have long-lasting effects, structural changes to the social protection system that would reduce child and family poverty should be the focus of public policies. Although the Malaysian government has established effective social security programs, nutritional support has not been considered sufficiently. Social protection systems must incorporate food- and nutrition-sensitive programs to safeguard food availability and enhance nutrition outcomes during medical emergencies. Priority should be given to women and children, particularly those from low-income homes. Moreover, to ascertain the root causes and consequences of household food insecurity, a more robust study design, such as a cohort study, is recommended. Furthermore, having better knowledge of household food insecurity in Malaysia, policies, and interventions to combat household food insecurity among high-risk populations may be put into place. Improvements in household income, access to education, and employability should be included in interventions and planning.

Finally, several recommendations are made for future research. The first recommendation is to conduct a study with a large sample size. The larger the sample size, the more accurate the average values are. Larger sample sizes also help researchers identify outliers in the data and provide smaller error margins. Secondly, as this study only reflects the urban population in Selangor, the exact level of food insecurity and dietary diversity may not be appropriately reported. Hence, future studies should be conducted in rural areas to provide significant results.

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DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

REFERENCES

Abdullah A, Zhou D, Shah T, Ali S, Ahmad W, Din I, Ilyas A. 2017. Factors affecting household food security in rural northern hinterland of Pakistan. J Saudi Soc Agric Sci 18(2):201–210. https://doi.org/10.1016/j.jssas.2017.05.003

Adams EL, Caccavale LJ, Smith D, Bean MK. 2020. Food insecurity, the home food environment, and parent feeding practices in the era of COVID-19. Obesity 28(11):2056–2063.

Ajao KO, Ojofeitimi EO, Adebayo AA, Fatusi AO, Afolabi OT. 2010. Influence of family size, household food security status, and childcare practices on the nutritional status of under-five children in Ile-Ife, Nigeria. Afr J Reprod Health 14(4 Spec no.):117–126.

Ali D, Saha KK, Nguyen PH, Diressie MT, Ruel MT, Menon P, Rawat R. 2013. Household food insecurity is associated with higher child undernutrition in Bangladesh, Ethiopia, and Vietnam, but the effect is not mediated by child dietary diversity. J Nutr 143(12):2015–2021.

Birhane T, Shiferaw S, Hagos S, Mohindra KS. 2014. Urban food insecurity in the context of high food prices: A community-based cross-sectional study in Addis Ababa, Ethiopia. BMC Public Health 14:680.

Coates J, Swindale A, Bilinsky P. 2007. Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide v3. Washington (USA): Food and Nutrition Technical Assistance Project (FANTA)

[DOSM] Department of Statistics Malaysia. 2020. Household income & basic amenities survey report 2019. https://v1.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=120&bul_id=TU00TmRhQ1N5TUxHVWN0T2VjbXJYZz09&menu_id=amVoWU54UTl0a21NWmd

hMjFMMWcyZz09 [Accessed 20th June 2023].

Elias SMS, Ibrahim NS, Sutantri S. 2023. Food Insecurity and Coping Strategies amongst undergraduate students during the COVID-19 pandemic in Malaysia. Malays J Med Health Sci 19(2).

[FAO] Food and Agriculture Organization 2021. The state of food xecurity and nutrition in the world 2021; The world is at a critical juncture. https://www.fao.org/state-of-food-security-nutrition [Accessed 24th June 2022].

Hasan MM, Kader A, Asif CAA, Talukder A. 2023. Seasonal variation in the association between household food insecurity and child undernutrition in Bangladesh: Mediating role of child dietary diversity. Matern Child Nutr Nutrition 19(2):e13465. https://doi.org/10.1111/mcn.13465

Hao Q. 2022. Relationship between household income, region and household healthcare expenditure-empirical research based on the data of China Family Tracking Survey (CFPS). BCP Business and Management 27:222–235. https://doi.org/10.54691/bcpbm.v27i.1967

Hussein FM, Ahmed AY, Muhammed OS. 2018. Household food insecurity access scale and dietary diversity score as a proxy indicator of nutritional status among people living with HIV/AIDS, Bahir Dar, Ethiopia, 2017. Plos One 13(6):e0199511. https://doi.org/10.1371/journal.pone.0199511

Grimaccia E, Naccarato A. 2018. Food insecurity individual experience: A comparison of Economic and Social Characteristics of the most vulnerable gtroups in the world. Soc Indic Res 143:391–410. https://doi.org/10.1007/S11205-018-1975-3

Iftikhar A, Bari A, Bano I, Masood Q. 2017. Impact of maternal education, employment, and family size on nutritional status of children. Pakistan J Med 33:1401–1405. https://doi.org/10.12669/pjms.336.13689

Khan Z, Ali A. 2023. Global Food Insecurity and Its Association with Malnutrition. Emerging Challenges in Agriculture and Food Science Volume 8. United Kingdom (UK): BP International.

Kittiprapas S. 2022. Socioeconomic impacts of the COVID-19 pandemic on the vulnerable households: Empirical evidence from slum areas of Bangkok city. Cogent Soc Sci 8(1):1–26. https://doi.org/10.1080/23311886.2022.2074111

Koyratty N, Mbuya MN, Jones AD, Schuster RC, Kordas K, Li CS, Tavengwa NV, Majo FD, Chasekwa B, Ntozini R, Humphrey JH. 2022. Implementation and maintenance of infant dietary diversity in Zimbabwe: contribution of food and water insecurity. BMC Nutrition 8(1):136.

Loopstra R, Tarasuk V. 2013. The severity of household food insecurity is sensitive to changes in household income and employment status among low-income families. J Nutr 1438:1316–1323. https://doi.org/10.3945/jn.113.175414

Olsen C, St George, DMM. 2004. Cross-sectional study design and data analysis. College Entrance Examination Board 26(03):2006.

Pachter LM, Coll CG, Perez-Brena NJ, Lopez LM, Halgunseth LC, Mistry RS, Stein GL, Carlo G. 2020. Assessing the impact of COVID-19 on children and youth. Dela J Public Health 6(2):40.

Palansamy Y. 2021. Covid-19: 580,000 M40 households fall into B40 category, absolute poverty rises to 8.4pc, says PM. Kuala Lumpur: Malay Mail. https://www.malaymail.com/news/malaysia/2021/09/21/covid-19-580000-m40-households-fall-into-b40-category-absolute-poverty-rise/2007310 [Accessed 5th June 2023]

Salleh NW, Hamid SBA, Nor NM, Shuhaimi FA, Zaman MK, Ismail NH. 2021. Diet quality and growth status of children aged two to six years at Tuba Island, Langkawi, Malaysia. J Gizi Pangan 16(3):159–168. https://doi.org/10.25182/jgp.2021.16.3.159-168

Syafiq A, Fikawati S, Gemily SC. 2022. Household food security during the COVID-19 pandemic in urban and semi-urban areas in Indonesia. J Health Popul Nutr 41(1):4.

Shariff ZM, Ang M. 2001. Assessment of food insecurity among low income households in Kuala Lumpur using the Radimer/Cornell food insecurity instrument–a validation study. Malays J Nutr 7(1 & 2):15–32.

Shariff ZM, Khor GL. 2008. Household food insecurity and coping strategies in a poor rural community in Malaysia. Nutr Res Pract 2(1):26–34.

Suryana S, Utama LJ, Fitri Y, Yunianto AE, Diana R, Bustami B. 2023. Household food insecurity and children dietary diversity during the COVID-19 outbreak. Aceh Nutri J 8(2):155–164. https://doi.org/10.30867/action.v8i2.713

Tan ST, Tan CX, Tan SS. 2022. Food security during the COVID-19 home confinement: A cross-sectional study focusing on adults in Malaysia. Hum Nutr Metab 27(200142):1–4

[UNICEF] The United Nations Children's Fund. 2020. Addressing Malaysia's nutrition crisis post-COVID-19: Time for nutrition-focused social protection. Policy Brief. https://www.unicef.org/malaysia/reports/addressing-malaysias-nutrition-crisis-post-covid-19 [Accessed 10th July 2023]

[WHO] World Health Organization. 2021. Indicators for assessing infant and young child feeding practices: Definitions and measurement methods. https://www.who.int/publications/i/item/9789241596664 [Accessed 3rd June 2023].