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Associations between food expenditure, food consumption score, food adequacy, and food security level among prison officers in Malaysia

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ABSTRACT

Introduction: Food security, defined as consistent access to sufficient, safe, and nutritious food, remains a significant challenge in Malaysia, especially among low-income households. This study examined associations between food expenditure, food consumption, food adequacy, and food security among lower-ranking prison officers in the B40 income group. **Methods:** Multistage sampling was used to select study locations and prisons in Malaysia. Purposive sampling was used to select 420 officers, who completed a self-administered, validated questionnaire. Data were analysed descriptively and through multiple linear regression to identify key predictors of food security. **Results:** All respondents (100%) had acceptable Food Consumption Scores (FCS), with 97.1% showing high food adequacy. However, the vast majority (89.5%) were classified as at risk of food insecurity. Food spending was predominantly directed towards staple cereals and animal proteins, such as chicken and meat, while expenditure on fruits, vegetables, and dairy products was much lower. Food expenditure was strongly linked to food insecurity (β =-0.588, p<0.001). Similarly, food consumption score (β =-0.087, p=0.038) and food adequacy (β =-0.127, p=0.003) were both negatively associated with food insecurity. **Conclusion:** Although Malaysian prison officers generally had adequate diets, a substantial proportion of households remained food insecure, particularly in terms of dietary diversity and micronutrient intake. Household food expenditure, consumption scores, and food adequacy were all linked to lower food insecurity.

Keywords: food adequacy, food consumption, food expenditure, food security, Malaysian prison officer

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INTRODUCTION

Food security is defined as the condition in which individuals consistently have both economic and physical access to sufficient, safe, and nutritious food to meet their dietary needs and lead healthy lives, supported by three key pillars – availability, access, and utilisation. Their stability determines overall food security, and disruptions to any pillar increase the risk of food insecurity (Jereme *et al.,* 2017; Guo *et al.,* 2021). Despite advances in agriculture and living standards, global food insecurity remains a pressing challenge. Globally, between 702 and 828 million people experienced hunger in 2021, and approximately 2.33 billion faced moderate or severe food insecurity in 2023, driven by conflicts, climate-related events, and economic slowdowns (Fan, Zhu & Fang, 2023). The burden is unevenly distributed, with Africa showing the highest prevalence; significant rates are also observed in South Asia, the Caribbean, and Central America, highlighting the need for targeted interventions to address structural drivers of food insecurity (FAO *et al.,* 2024). The Global Food Security Index (GFSI) further underscores national vulnerabilities; Malaysia ranked 41st in 2022 with a score of 69.9, a slight decline from 2021, reflecting moderate food security (Ministry of Agriculture and Food Security, 2024).

Food security is a multidimensional concept encompassing availability, access, utilisation, and stability; it is often measured using economic and nutritional indicators (Allee, Lynd & Vaze, 2021). Household food expenditure serves as a critical measure of economic access, while caloric availability and dietary diversity reflect consumption patterns and nutritional quality (Bertelli, 2019). Although the proportion of income spent on food can indicate financial access relative to local standards (Stratan, Lopotenco, & Staver, 2024), it does not fully capture diet quality. Consequently, dietary diversity measures are necessary to understand how economic resources translate into nutritional adequacy (Ogunniyi *et al.,* 2024). Food insecurity, defined as limited or uncertain access to safe and nutritious food, can be assessed at multiple levels, including national, state, and household (Jones *et al.,* 2013). Evidence links food insecurity with adverse health outcomes and risk factors such as low income, minority status, advanced age, and social isolation (Coleman-Jensen *et al.,* 2017).

Household consumption expenditure surveys offer an integrated approach, capturing economic indicators such as the share of spending on food, per capita food expenditure, and vulnerability to food poverty, alongside dietary diversity measures such as the Food Consumption Score (FCS) and the Household Dietary Diversity Index (Russell *et al.,* 2018). However, the relationship between expenditure and consumption is complex. Higher spending may indicate greater caloric availability and dietary diversity, yet it can coincide with poorer subjective food security among low-income households (Bertelli, 2019). Integrating expenditure and diversity measures improves accuracy and reduces misclassification, as reliance on a single indicator may overlook coping strategies or aspects of diet quality (Manikas, Ali & Sundarakani, 2023). These complementary measures provide a more comprehensive assessment of household food security by capturing both quantity and nutritional quality (Bushara, 2021).

Food security is particularly critical for individuals in correctional facilities, where consistent access to safe and nutritious food supports physical health, cognitive function, and institutional efficiency (Tan, Tan & Tan, 2022). While research has examined food insecurity

among Malaysian households, especially vulnerable groups, such as low-income families and working women (Sapry & Zulkifli, 2023), little is known about its impact on prison officers. Limited access to nutritious food may compromise their health and job performance (Le, Samad & Yusof, 2024). By applying the established pillars of food security – availability, access, utilisation, and stability – this study addressed a critical gap in understanding how institutional employment intersects with nutritional challenges (Azmi, Zailani & Roni, 2023). Accordingly, this research examined the relationships between food expenditure, FCS, food adequacy, and food security levels among Malaysian prison officers.

METHODOLOGY

Study design

This study used a quantitative research approach to investigate the research objective. Data were collected through structured surveys, which provided both general and specific information from respondents. The study design facilitated systematic and reliable data collection to meet the study goals. The survey method was selected for its efficiency in gathering data from a representative sample, which allowed for quantifying variables and performing statistical analysis to identify patterns and relationships. This study was conducted from February to April, 2025.

Study location

This study was conducted at selected prison locations in Malaysia. The selection of states in Peninsular Malaysia was made through multistage sampling. Peninsular Malaysia was divided into four (4) zones, namely northern, southern, east coast, and western, as follows:

i. Northern zone – Perlis, Kedah, and Penang

ii. Southern zone – Johor, Negeri Sembilan, and Melaka

iii. East Coast zone – Kelantan, Terengganu, and Pahang

iv. Western zone – Perak and Selangor

One state was selected from each zone. Each selected state was represented by one prison as the study location. Sabah and Sarawak were both included in the data collection.

Sampling method and subject recruitment

A total of 70 prison officers were selected as respondents from each state. Respondents were selected through purposive sampling, with only those in the B40 income category eligible to participate in this study. For each selected prison, a list of lower-ranked prison officers was obtained. Prison officers who met the inclusion criteria were selected until 70 people per prison per zone were reached. Once the required number was met, respondent selection stopped. This procedure was applied to all selected zones. The total number of respondents was 420.

Individuals working in the selected prison department were chosen to be respondents in the study if they met the following inclusion criteria:

i. Lower-ranking prison officers ranked as Sub Inspector (KA4), Sergeant Major (KA3), Sergeant (KA2), Corporal (KA1), and Warder (KA1).

ii. Have served in the Malaysian Prison Department for 3 years or more

iii. Household income of less than RM5,249 per month

iv. Responsible for household's food purchasing

Prison officers who had these criteria were excluded as respondents:

i. High-ranking prison officers (Grade KA5 and above).

ii. Have served in the Malaysian Prison Department for less than 3 years

iii. Working in the Malaysian Prison Department as non-uniform staff

iv. Household income of more than RM5,249 per month

v. Not responsible for household's food purchasing

Research instruments

The research instrument employed in this study was a structured questionnaire, designed to systematically capture respondents' sociodemographic characteristics, dietary patterns, food expenditure, and household food security. The questionnaire comprised four main sections. Section A collected background information on respondents' age, gender, monthly income, education level, marital status, ethnicity, household size, years of service, and occupational rank, providing a comprehensive profile of the study population.

Section B focused on food intake and incorporated two key measures: FCS and food adequacy. FCS, developed by the World Food Programme (WFP, 2024), is a validated proxy for household food security that assesses both dietary diversity and the frequency of consumption across major food groups over the previous seven days. Respondents reported how often they consumed cereals, meats, legumes, dairy, fruits, vegetables, oils, sugars, and condiments. Each food group was weighted according to its nutritional value, and consumption frequencies (scored 0 to 7) were multiplied by these weights and summed to generate a total FCS ranging from 0 to 112. Households were then classified into three categories: poor (0–28), borderline (28.5–42), and acceptable (42.5–112), with higher scores indicating adequate and diverse dietary intake and lower scores signalling potential food insufficiency and need for intervention. Food adequacy was assessed using the Malaysian Food Variety Indicator (MFVI) (Zainal Badari *et al.,* 2018), covering eight key food groups. Each group was scored based on daily servings, yielding a total score from 0 to 70, with classifications of low (0–23), moderate (24–48), and high (49–70) adequacy, reflecting the overall nutritional balance of respondents' diets.

Section C required respondents to report weekly food expenditures by food group, enabling analysis of economic access and spending priorities.

Section D assessed household food security using six items adapted from the Malaysian Adults Nutrition Survey (MANS) 2014 (IPH, 2014), including questions on insufficient food quantity, inability to afford a variety of foods, meal reductions, skipped meals, reliance on cheap foods for children, and inability to provide diverse foods for children due to financial constraints. Responses were scored by frequency ('almost every month' = 1, 'several months but not every month' = 2, 'only one or two months' = 3, 'never' = 4), generating a total score range of 6 to 24. Scores of 21 or above indicated no risk of household food insecurity, while scores of 20 or below indicated a risk, following the classification method of Ahmad, Naidu & Salleh (2018). This comprehensive questionnaire enabled simultaneous assessment of dietary diversity, adequacy, economic food access, and household food security, providing robust data for analysis of the relationships among expenditure, consumption, and food insecurity among respondents.

Data collection and ethical clearance

Researchers asked respondents to complete the questionnaire independently

Table 1. Sociodemographic characteristics of respondents

Characteristics	*n*	*%*
Age group (years)		
20-30	266	63.3
31-40	144	34.3
41-50	9	2.1
≥ 51	1	0.2
Mean: 28.92±6.46		
Ethnicity		
Male	385	91.7
Female	35	8.3
Education level		
SPM	123	29.3
STPM / Diploma	284	67.6
Bachelor Degree	11	2.6
Other	2	0.5
Race		
Malay	272	64.8
Chinese	18	4.3
Indian	7	1.7
Bumiputera Sabah/Sarawak	123	29.3
Marital status		
Single	224	53.3
Married	196	46.7
Household size (person)		
1 – 2	242	57.6
3 – 4	124	29.5
5 – 6	53	12.6
≥ 7	1	0.2
Mean: 2.32±1.61		
Occupation		
Warder	246	58.6
Corporal	153	36.4
Sergeant	21	5.0
Grade		
KA1	233	55.5
KA2	166	39.5
KA3	21	5.0
Monthly income (RM)		
1500 – 2000	216	51.4
2001 – 2500	27	6.4
2501 – 3000	63	15.0
3001 – 3500	94	22.4
≥ 3501	20	4.8
Mean: 2393.19±664.49		
Monthly allowance (RM)		
100 – 400	85	20.2
401 – 800	98	23.3
801 – 1200	194	46.2
1201 – 1600	24	5.7
≥ 1601	19	4.5
Mean: 829.56±381.97		

To be continued...

Table 1. Sociodemographic characteristics of respondents *(Continued)*

Characteristics	*n*	*%*
Service period (year)		
1 – 5	246	58.6
6 – 10	33	7.9
11 – 15	63	15.0
16 – 20	77	18.3
≥ 21	1	0.2
Mean: 7.27±6.45		
Service placement (prison)		
Sungai Buloh, Selangor	70	16.7
Sungai Udang, Malacca	70	16.7
Marang, Terengganu	70	16.7
Pokok Sena, Kedah	70	16.7
Bintulu, Sarawak	70	16.7
Tawau, Sabah	70	16.7

SPM: Sijil Pelajaran Malaysia; STPM: Sijil Tinggi Pelajaran Malaysia; KA1: Corporal; KA2 Sergeant: KA3: Sergeant Major

(self-administered), with assistance from a researcher if needed. Respondents were asked to provide their consent to participate by completing a consent form included with this study. Ethical clearance for this study was approved by the Ethics Committee for Research Involving Human Subjects, Universiti Putra Malaysia, under reference number JKEUPM-2025-255.

Data analysis

Data were analysed using IBM SPSS Statistics (version 29) (IBM Corp, Armonk, New York, USA) to determine the frequency and mean values of variables such as age, income, household size, and total food expenditure among the respondents. A multiple linear regression test was used to identify which variables were most strongly associated with respondents' food security levels. Before performing the multiple linear regression analysis, all key assumptions were evaluated and confirmed to be met. Linearity was assessed using scatterplots for each independent variable against the dependent variable; independence of error was examined with the Durbin-Watson test; homoscedasticity was checked via residuals versus predicted values plots; normality of residuals was evaluated using Q-Q plots; and multicollinearity was assessed through variance inflation factor (VIF) values. These diagnostics indicated that all assumptions were satisfied, supporting the validity and reliability of the regression results.

RESULTS

Respondents' background

Respondents' backgrounds are shown in Table 1. The respondents had an average age of 28.92 years, with the majority aged 20-30 years (63.3%). Males comprised the majority (91.7%), and most had an education level of STPM/ Diploma (67.6%). Ethnically, Malays were the largest group (64.8%), followed by Sabah/Sarawak Bumiputera (29.3%). Over half were single (53.3%), with an average household size of 2.32 persons. Most worked as Prison Warder Grade KA1 (58.6%), with a monthly income averaging RM2,393.19, primarily in the RM1,500-2,000 range (51.4%). The average length of service was 7.27 years, and respondents were evenly distributed across six prison institutions.

Table 2. Mean food expenditure and range among respondents

Food group	*Mean (RM)*	*Standard deviation (SD)*	*N*	*%*
Chicken	25.85	12.93		
Meat	25.21	18.15		
Cereals (rice, noodles, rice vermicelli, kway teow, cereal products, tubers, etc.)	24.17	10.79		
Seafood (shrimp, squid, crab, clams, etc.)	21.21	11.21		
Fruits	19.79	15.66		
Vegetables	19.64	13.65		
Dry ingredients (onion, garlic, ginger, spices, etc.)	19.15	17.24		
Fish	18.11	7.84		
Cooking oil	17.14	6.58		
Beverage ingredients (coffee, tea, Milo, Nescafe, etc.)	16.96	4.81		
Condiments (chili sauce, soy sauce, seasoning, salt, etc.)	16.57	5.69		
Alcohol/tobacco	15.08	10.62		
Confectionery (local cakes, cakes, ice cream, ABC dessert, jelly, etc.)	14.98	10.98		
Eggs	14.08	9.58		
Nuts and legumes	11.93	11.57		
Milk and dairy products	10.87	4.89		
Sugar	9.87	7.27		
Total	300.61	179.44		
Food expenditure range (RM)				
100-200			136	32.4
201-300			122	29.0
301-400			62	14.8
401-500			40	9.5
≥ 501			60	14.3

Food expenditure

Table 2 shows the respondents' average weekly food expenditure. Respondents spent the most on chicken (RM25.85), meat (RM25.21), and cereals (RM24.17) per week. The least purchased food groups were nuts and legumes (RM11.93), milk and dairy products (RM10.87), and sugar (RM9.87). On average, respondents allocated RM300.61 per week for family food purchases, excluding meals outside the home. Most respondents (61.4%) spent between RM100 and RM300 per week on food (32.4% between RM100 and RM200 and 29.0% between RM201 and RM300). Higher food expenditure of above RM400 was less common (23.8%). The RM301-400 range accounted for 14.8% of respondents, indicating moderate spending.

Food consumption score (FCS)

The analysis revealed consistent and adequate dietary patterns among respondents, as shown in Table 3. FCS results showed that all 420 respondents (100%) fell within the acceptable range for food consumption, indicating satisfactory dietary diversity and nutritional adequacy. Across food groups, intake was generally stable and sufficient. The meat, poultry, fish, and eggs group recorded the highest and most consistent average score (M=28.00, *SD*=0.00), reflecting uniform protein intake from animal sources. The cereals, grains, roots, and tubers group also showed complete uniformity (M=14.00, *SD*=0.00), confirming their role as dietary

Table 3. Food consumption and adequacy scores of respondents

Food Group / Category	*Mean Score*[†/‡]	*Minimum Score*[†/‡]	*Maximum Score*[†/‡]	*Standard Deviation (SD)*[†/‡]	*Remarks / Category*
Cereals, grains, roots, and tubers	14.00 / 7.262	14.00 / 5.000	14.00 / 10.000	0.00 / 1.985	
Vegetables	4.16 / 8.143	1.00 / 5.000	7.00 / 10.000	2.42 / 2.418	
Fruits	2.86 / 8.881	1.00 / 5.000	7.00 / 10.000	1.52 / 2.086	
Poultry and eggs	- / 5.000	- / 5.000	- / 5.000	- / 0.000	
Meat	- / 5.000	- / 5.000	- / 5.000	- / 0.000	
Fish	28.00 / 10.000	28.00 / 5.000	28.00 / 10.000	0.00 / 0.000	
Legumes/pulses, nuts, and seeds	4.31 / 9.738	0.00 / 0.000	21.00 / 10.000	1.94 / 1.598	
Milk and other dairy products	7.42 / 7.036	4.00 / 0.000	28.00 / 10.000	3.65 / 2.713	
Oils/fats/butter	1.36 / -	0.50 / -	3.00 / -	0.65 / -	
Sugar and sweets	3.06 / -	1.00 / -	5.50 / -	0.72 / -	
Total score	65.17 / 61.059	53.50 / 35.000	106.00 / 70.000	5.96 / 5.687	
Food consumption scores threshold	-	-	-	-	Acceptable food consumption (42.5–112): 100%
Food adequacy category	-	-	-	-	High food adequacy (49–70): 97.1% Moderate: 2.9%

[†]Food consumption scores
[‡]Food adequacy scores

Table 4. Respondents' food security statements and levels

Statement: *How often is this statement true for you/your family?*	*n (1)*	*%*	*n (2)*	*%*	*n (3)*	*%*	*n (4)*	*%*	*N*	*%*
The food I buy is not enough, and I don't have the money to buy more.	2	0.5	225	53.6	188	44.8	5	1.2		
I cannot afford to buy the variety of foods that should be bought.	40	9.5	125	29.8	250	59.5	5	1.2		
In the past 12 months, I (and/or adult family members) have reduced meal portion sizes due to a lack of money to buy food.	16	3.8	230	54.8	139	33.1	35	8.3		
In the past 12 months, I (and/or adult family members) have skipped main meals due to lack of money to buy food.	3	0.7	43	10.2	195	46.4	179	42.6		
I rely on only a few inexpensive types of food to feed the children due to lack of money.	3	0.7	78	6.0	124	29.5	215	51.2		
I am unable to provide a variety of foods to the children due to lack of funds.	2	0.5	31	4.0	164	39.0	223	53.1		
Food Insecurity Level										
At risk of household food insecurity (0 – 20)									376	89.5
No risk of household food insecurity (21 and above)									44	10.5

1 = Almost every month; 2 = Some months but not every month; 3 = One or two months only; 4 = Never

staples. However, greater variability was observed in legumes/pulses, nuts, and seeds (M=4.31, *SD*=1.94) and milk and dairy products (M=7.42, *SD*=3.65), indicating inconsistent consumption among respondents. Vegetable (M=4.16, *SD*=2.42) and fruit (M=2.86, *SD*=1.52) consumption showed moderate variation, suggesting differences in intake frequency. Meanwhile, oils/fats/butter (M=1.36, *SD*=0.65) and sugar/sweets (M=3.06, *SD*=0.72) had low mean scores and limited variability, suggesting controlled consumption of these items.

Food adequacy

Analysis of the food adequacy score revealed that respondents generally maintained a balanced, nutritionally adequate diet across major food groups. Table 3 shows that the overall mean food adequacy score was 61.06 (*SD*=5.69), indicating a good level of dietary adequacy with moderate variation among respondents. High consistency in consumption was observed in fish (M=10.00, *SD*=0.00) and poultry and eggs (M=5.00, *SD*=0.00), suggesting stable protein intake at recommended levels. Cereals, grains, roots, and tubers (M=7.26, *SD*=1.99) were consumed adequately as staple foods, while vegetables (M=8.14, *SD*=2.42) and fruits (M=8.88, *SD*=2.09) showed generally high intake with moderate variation, reflecting good dietary attention to plant-based foods. Consumption of legumes/pulses, nuts, and seeds (M=9.74, *SD*=1.60) and milk and dairy products (M=7.04, *SD*=2.71) displayed greater variability, indicating inconsistent consumption patterns among respondents. The classification of food adequacy levels showed that none of the 420 respondents fell into the low adequacy category; 2.9% (*n*=12) were in the moderate adequacy group and 97.1% (*n*=408) achieved high food adequacy.

Table 5. Associations of food expenditure, food consumption score, and food adequacy with food insecurity level among respondents

Variable	*Beta*	*SE*	*95% CI*		β	*p*
			LL	*UL*		
Food expenditure	-0.004	0.000	-0.004	-0.003	-0.588	<0.001**
Food consumption score	-0.040	0.019	-0.079	-0.002	-0.087	0.038*
Food adequacy	-0.062	0.021	-0.102	-0.021	-0.127	0.003**

**p<0.01, * p<0.05; R^2=0.476

Food security

Analysis of household food security in Table 4 revealed that a significant proportion of respondents faced challenges maintaining consistent access to sufficient, quality foods. The average household food security score was 17.52 (min=7.0, max=24.0), indicating overall vulnerability. A total of 89.5% (n=376) of households were classified as at risk of food insecurity, while only 10.5% (n=44) were not at risk, reflecting limited stability in food access among most respondents. Findings showed that 9.5% of households were unable to purchase certain foods almost every month, while 29.8% experienced this occasionally. Additionally, 3.8% reported reducing meal portions due to financial constraints, with 54.8% reported doing so within several months. In addition, 10.2% skipped main meals, 18.6% relied on cheaper foods to feed their children, and 7.4% were unable to prepare a variety of foods for their children due to financial constraints.

Associations of food expenditure, food consumption score, and food adequacy with food security level among respondents

The multiple linear regression analysis revealed significant relationships between food expenditure, food consumption score, and food adequacy with household food insecurity levels, as shown in Table 5. Food expenditure was strongly linked to food insecurity (β=-0.588, p<0.001), indicating that higher per-person food spending was associated with lower levels of food insecurity. Similarly, food consumption score (β=-0.087, p=0.038) and food adequacy (β=-0.127, p=0.003) were both negatively associated with food insecurity, suggesting that more dietary variety and sufficient food availability led to less food insecurity. These factors together accounted for 47.6% of the differences in food insecurity (R^2=0.476). Sociodemographic variables like age, gender, and education were assessed as potential confounders. Initial analyses revealed that these variables were not significantly associated with the outcome and did not improve model fit. As a result, they were excluded from the final multiple linear regression model to keep it simple and focused on the main predictors.

DISCUSSION

The findings on respondents' food expenditure revealed key insights into their dietary habits and nutritional quality. On average, respondents spent RM300.61 per week on food, which is 37.3% higher than that spent by households in Malaysia. On average, Malaysian households' weekly expenditure on food at home in 2024 was RM219.00 (Department of Statistics Malaysia, 2024). This indicates an increase in food prices, particularly in the categories of live animals, meat and other parts of slaughtered land animals, as well as cereals and cereal products (Department of Statistics Malaysia,

2024). This suggests that while food is affordable, there may be limited investment in dietary variety (Social Wellbeing Research Centre, 2019). The highest spending was on chicken and meat (RM51.06), indicating a preference for animal protein and reflecting national consumption trends and cultural practices. Spending on cereals (RM24.17) confirmed their status as staple foods. Low intake of nuts, legumes, and dairy suggests limited food variety and potential nutrient gaps, particularly in plant-based protein and calcium. Research shows that low intake of these items in Malaysia is influenced by cost, accessibility, and limited nutrition knowledge (Goh *et al.,* 2020; Kh'ng, Chang & Hsu, 2022).

The findings indicated that respondents generally had satisfactory dietary habits, characterised by consistent intake of staple foods and animal-based proteins, though with limited consumption of fruits and vegetables. This pattern aligns with national dietary trends reported by Goh *et al.* (2020), who found stable overall energy availability in Malaysia but a notable shift in food sources, characterised by declining rice consumption, increasing wheat and sugar intake, and a significant rise in animal-based protein supply relative to plant-based sources. Although a high FCS suggests sufficient calories and macronutrients, it does not indicate the amount or quality of each food group. Consequently, low fruit and vegetable intake raises concerns about micronutrient deficiencies, even with generally adequate FCS scores. Socioeconomic factors, limited knowledge about nutrition, and personal choices may explain these trends. Previous studies have found that many Malaysians do not meet the recommended daily intake of fruits and vegetables (Zin, Rosnan & Shafee, 2022; Lo, Lee & Cheng, 2022; IPH, 2014). Food adequacy suggested a generally balanced diet among respondents, but certain methodological issues, such as uniform scoring across some food items, may obscure differences in actual consumption (Moorthy *et al.,* 2024). Overall, most respondents were nutritionally adequate, although continued nutrition education and awareness efforts could further promote consistent consumption of less-consumed food groups.

Even with generally acceptable food intake, 89.5% of households faced a risk of food insecurity. This shows that meeting intake guidelines does not guarantee food security. Financial issues caused 42.6% of respondents to skip main meals, and over 50% relied on cheap, repetitive foods, which reduced dietary variety and may affect nutritional health and child development (Angeles-Agdeppa *et al.*, 2021). These behaviours reflect household coping strategies, such as focusing on staples, adjusting portions, or relying on social support, which help maintain caloric intake but may lower diet quality. Differences in measurement methods and access to assistance programmes may also have affected these results. Overall, the results indicate that while some households maintained food stability, most experienced periodic challenges in food access, likely linked to economic limitations, which can affect nutritional quality and overall household well-being.

The study highlights the complex links between food expenditure, consumption, and security. Even with sufficient expenditure and high consumption scores, households, especially those living in urban poverty, struggle to maintain a balanced diet rich in fruits, vegetables, and quality protein. Reliance on cheap, energy-dense foods may provide calories but compromise nutritional quality (Kh'ng *et al.,* 2022). These findings highlight the shortcomings of policies that focus mainly on food availability rather than nutritional quality. Greater

emphasis should be placed on economic access, dietary diversity, and nutrient levels when evaluating household food security (Ramli, Kasa & Yusof, 2024). Ensuring food security requires not just enough calories but also steady access to a range of nutrient-rich foods to support health and well-being.

Study limitation

This study had several limitations. Firstly, data were self-reported, which could lead to recall or social desirability bias. Secondly, the selective sampling of lower-ranking B40 prison officers limits the extent to which the findings can be generalised to other groups. Thirdly, dietary measures such as FCS and the food adequacy index provide general estimates but may not accurately reflect nutrient levels or micronutrient intake. Finally, some food groups showed uniform scores, indicating possible methodological issues.

CONCLUSION

In conclusion, this study showed that prison officers generally had adequate diets, but many remained at risk of food insecurity. While respondents consistently ate staple foods and animal-based proteins, the varying amounts of fruits, vegetables, legumes, and dairy suggested gaps in dietary diversity and micronutrient intake. Household food expenditure, food consumption scores, and food adequacy were all strongly linked to food insecurity. Together, these factors explained almost half of the differences in food security. This highlights the important roles of economic access, dietary variety, and sufficient food availability. These findings also revealed that having enough food does not always prevent vulnerability. Therefore, focused efforts, such as nutrition education and support programmes, are needed to improve access to and quality of diets for low-income prison officers.

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Authors' contributions

Mohamad Zulkefly MY, principal investigator, conceptualised and designed the study, led the data collection, analysed the data, and prepared the draft of the manuscript; Shamsul Azahari ZB, advised on data analysis and interpretation and reviewed the manuscript; Nur Aqilah AJ, assisted in data analysis and interpretation, assisted in drafting the manuscript, and reviewed the manuscript.

Conflict of interest

No conflicts of interest among authors.

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