Research Article

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Household Food Security in Sarawak: a Hierarchical Binary Logistic Regression Analysis

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Abstract

Introduction: Food security exists when people at all times have physical and economic access to sufficient security and nutritive food that meets their dietary needs and food preferences for an active and healthy life. Objective: We examined the relationship between household food security with three constructs, viz., food waste behaviour, food planning routines, and social cohesion. **Methods:** This was a cross-sectional study. A multistage random sampling method was used to select households across Sarawak. Data from a total of 2,065 respondents were collected via face-to-face interviews. Data analysis was conducted using SPSS version 27.0. A p-value of < .05 was considered to be statistically significant. **Results:** Of the respondents, 37.2% were food insecure. Hierarchical binary logistic regression revealed that food planning routine increased the odds of household food insecurity by 27% (AOR= 1.27, 95% CI: 1.13-1.44), while social cohesion reduced the odds of food insecurity by 11% (AOR= 0.89, 95% CI: 0.81-0.97). However, no significant finding was found between food waste behaviour and food security. Conclusion: Findings from the current study can strengthen the understanding of household food security among Sarawak population. Long-term programmes focusing on reducing food insecurity would be effective by promoting social cohesion among the public.

Keywords: Food security, Food waste, Social cohesion, Food planning routines, Sarawak

Introduction

Food security occurs when people have physical and economic access to sufficient security and nutritive food at all time.[1] Everyone's dietary needs and food preferences must also be met so that they can have an active and healthy life. Food security contains four dimensions, i.e., physical availability of food, economic and physical access to food, food utilisation, and stability of the other three dimensions over time. These four dimensions must be attained at the same time for a country to achieve food security objectives. If a person or household is unable to accomplish any of the four dimensions, they will experience food insecurity. Food insecurity describes the uncertainty in food accessibility at the individual or household level. This uncertainty can directly (through compromised diets) and indirectly (through inadequate feeding or disordered eating patterns) lead to insufficient protein, calories, minerals, and vitamin intakes that may cause micronutrient deficiencies, wasting, and stunting.[2]

To better visualise food security in a country, food security is categorised into four groups.[3] The first one is food-secure group, followed by mild food insecurity, described as having uncertainty in acquiring food. The third group is moderate food insecurity. The individuals or households have insufficient money for a healthy diet, are uncertain about obtaining food, and occasionally run out of food. The last group is severe food insecurity, whose individuals or households do not have any food for a day or more in a year. In 2019, Food and Agriculture Organization (FAO) reported that more than one quarter of the world population were moderately or severely food-insecure.[4] This result translated to 2 billion people being food-insecure. The region with the highest food insecurity was Africa, with half its population being food-insecure. One-third of the Latin American population and one-fifth of the Asian population were food-insecure. The remaining regions, i.e., Oceania, Northern America, and Europe, also experienced food security.

Moreover, the FAO report also indicated that the South-eastern Asian region had food insecurity prevalence of 18.6%.[4] However, previous studies in Malaysia reported a higher percentage of food insecurity in some rural communities in Kelantan state, accounting for 29.5% of food insecurity.[5] Chong et al.[6] found a similar prevalence among aborigine communities in Selangor. Rahman et al.[6] found that 28.4% of Sarawak Dayak communities were food insecure. Apart from the research performed in various rural communities, the Institute for Public Health also carried out a National Health and Morbidity Survey 2014 to determine the nation's food security status.[8] They found that approximately one-quarter of the Malaysian population had

food insecurity. This percentage was higher than the food insecurity prevalence of 16.9% in the South-eastern Asian region in 2014.[4]

The current study aimed to study household food security in Sarawak and to explore its possible factors. Past studies mainly focused on the sociodemographic characteristics and children's nutritional status with food security.[7, 9, 10] There is lack of study on the relationship between food security and behavioural factors in this region. After extensive literature search, we put forth three constructs that may influence household food security in this context: food waste behaviour, food planning routines, and social cohesion.

Food waste behaviour examines how people reduce or increase food waste in their households.[11] Food waste represents the loss of any edible food that is planned for consumption.[12] This behaviour can often lead to food insecurity among the population.[13] Households with high food waste behaviour, i.e., wasting food unnecessarily, need to spend more money on getting more food. Simultaneously, the money spent on over-purchasing food cannot be spent on other activities to improve their financial status. Thus, it may lead to food insecurity in the future. Food planning routines are the usual routines performed by a person when managing food. These routines include making a list before shopping and planning meals ahead of time.[11, 14, 15] Proper planning would allow a person to spend their money effectively and efficiently. In turn, it will lead to food security in the future. Finally, social cohesion describes an individual's interconnectedness and unity among groups in society.[16] This feeling of connectedness with other community members allows individuals with food insecurity to get sufficient food supplies and awareness of assistance in securing food supplies.[17] Cohesive group members could also help each other during the critical period by sharing their resources.[18]

Materials and Methods

1. Study setting

The study was conducted using a cross-sectional method between October 2020 and August 2022. Respondents were systematically selected and interviewed based on specific inclusion criteria, i.e., adults aged 18 years and above living in the selected households in Sarawak, mentally sound, and responsible for catering for food in their respective households. The study was opened to both male and female Malaysians. Non-Malaysians or those living outside of the selected households were not included. Only one respondent was interviewed from each selected household.

2. Sample, sampling procedure, and data collection

A single proportion formula was used to determine the sample size for this study (19). With the anticipated prevalence of 30%,[5, 7] confidence interval of 95%, margin of error of 3%, design effect of two, and a non-response rate of 20%, the minimum sample size required was 2,160.

The sampling procedure used a multistage sampling approach. There were four stages in the sampling procedure for this study. Six divisions were randomly chosen in Sarawak state. Next, two districts were chosen from each selected division. Later, nine rural villages were randomly picked from each selected district. One-hundred and eight villages were included in this study. The list of villages was obtained from the respective District Offices, and the selection started with a random number, followed by every fifth interval. Finally, 20 households were systematically selected from each village, starting with the fifth house from the village chief's house. The sampling procedure is shown in **Figure 1.** Face-to-face interviews were performed to collect relevant data for this study. 12 interviewers from each district were recruited and trained individually to ensure each interviewer can get same information during interviews.

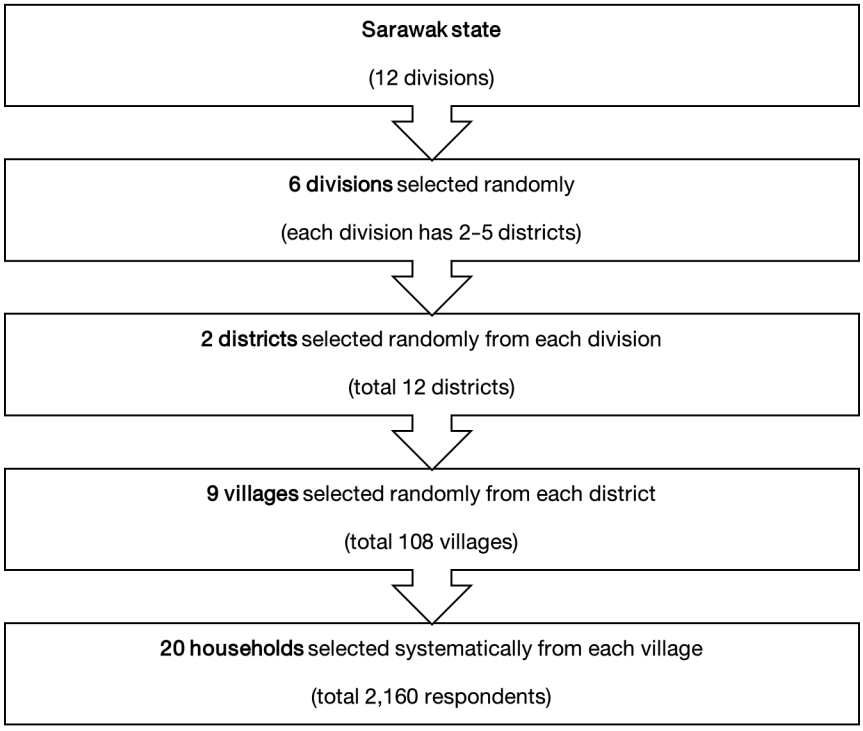

Figure 1 Sampling procedure

Household food security was examined using US Household Food Security Survey.[20] The module consisted of 18 items. Household without child under the age of 18 only answered first 10 items; household with one or more children under the age of 18 answered all the items. There were six items with the choices of often true, sometimes true, never true, and do not know. Respondents who chose often true and sometimes true were given a score of '1'; respondents who chose never true or do not know were given a score of '0'. Nine items had the choices of yes, no, and do not know. Respondents who answered yes were given '1' score, while respondents who answered no or do not know were given '0' score. The last three items were follow-up questions. Respondents who answered yes to questions 4, 8, or 13 were asked to answer the follow-up question. Respondents who answered no or do not know skipped to the following item. Respondents who answered some months but not every month and almost every month were given the score of '1', whereas respondents who answered only 1 or 2 months and do not know were given the score of '0'. Item scores were summed and classified into two groups, i.e., 'food-secure' and 'food-insecure'. Household with total score of 2 or below were considered food-secure, whereas household with total score of 3 or more were considered food-insecure. Food-secure group was coded '0' and food-insecure group was coded '1'.

Factors associated with household food security was assessed using 18 Likert-scale questions. These factors included respondents' food waste behaviour, food planning routines, and social cohesion. The statement for food waste behaviour was adopted from Rahman et al..[21] The scale comprised five rating scores ranging from one (1) "always" to five (5) "never". The statements for food planning routines were adapted from Aktas et al..[22] The statements for social cohesion were adapted from Sampson et al..[23] Respondents answered these statements using a seven-point Likert scale. The range of the scale were from 1=strongly disagree to 7=strongly agree. An overall mean score for each factor was calculated and used for further statistical analysis.

3. Pilot test

Wong and Rahman[24] conducted a psychometric evaluation of the developed questionnaire. For content validation, five content experts checked each item's relevance, clarity, simplicity, and ambiguity. All of the items had good index in scale-level content validity index (S-CVI) and item-level content validity index (I-CVI)

Next, a pilot test was carried out to determine the feasibility of the research. One hundred sixty-eight respondents were listed for the assessment. Issues related to practicality of

implementation such as resource requirement and time commitment were identified. During interviews, respondents were also asked for the clarity, simplicity, and ambiguity for each item. Unclear items were identified for further refinement.

For data analysis, there were no issues related to data interpretation. The Cronbach's alpha for each construct was good, with a reliability coefficient of 0.7 and above,[25] indicating good reliability. All the items showed a good correlation value of more than 0.3.[26] Upon refining ambiguous and unclear items, the instrument disclosed good reliability and validity in investigating household food security.

4. Statistical analysis

Data were screened, coded, and verified manually before transferring to a Microsoft Excel.[26] The data were later imported to IBM SPSS version 27 for analysis.[27] We did an exploratory data analysis to find the missing and duplicated entry.

The dependent variable was categorical data with two outcomes. Household food security was the dependent variable, while sociodemographic characteristics, food waste behaviour, food planning routines, and social cohesion were independent variables in the multivariate analysis. We identified the univariate and multivariate outliers based on Mahalanobis distance,[28] Cook's distance,[29] and studentised residuals.[30] A total of 95 data were removed, with the remaining 2,065 data were proceeded for further analyses. Next, assumptions for binary logistic regression, such as multicollinearity and linearity, were checked. The data did not violate the assumptions for binary logistic regression. For the statistical analysis, sociodemographic characteristics were entered into the first model, while food waste behaviour, food planning routines, and social cohesion were entered into the second model. A result was considered significant if its *p*-value was less than .05.

Results

1. Characteristics of the respondents

The respondents' mean (SD) age was 44.71 (12.78) years, ranging from 18 to 83 years old. The mean (SD) household income was RM2,305.46 (RM1,837.79), with a minimum of RM100 and a maximum of RM25,000. Almost two-thirds of the respondents were females (65.1%), and the remaining one-third were males (34.9%). Most of the respondents were of Dayak (69.7%) and Christianity faith (69.2%). Majority of the respondents had secondary education as their highest education level (61.5%) and were employed (54.3%) during the interview.

Table 1 Characteristics of the respondents (N=2,065)

Variables	n	%	Statistics
Age in years			Mean (SD)=44.71 (12.78); Min=18, Max=83
Gender			
Male	721	34.9	
Female	1,344	65.1	
Ethnicity			
Dayak*	1,439	69.7	
Non-Dayak◊	626	30.3	
Religion			
Islam	537	26.0	
Christianity	1,429	69.2	
Others§	100	4.8	
Education level			
No formal education	187	9.1	
Primary education	352	17.0	
Secondary education	1,270	61.5	
Tertiary education	256	12.4	
Occupation			
Employed	1,122	54.3	
Unemployed	943	45.7	
Household income			Mean (SD)=RM2,305.46 (RM1,837.79); Min=RM100, Max=RM25,000

*Dayak included the respondents of Iban, Bidayuh, Melanau, Kayan, Kenyah, Penan, Punan, and Selakau ethnicities.

◊Non-Dayak included respondents of Malay and Chinese ethnicities.

§Others included Buddhist and Atheist.

2. Household food security

Figure 2 shows the household food security status of the respondents. 62.8% of the household were found to be food-secure, while 37.2% of the household were found to be food-insecure.

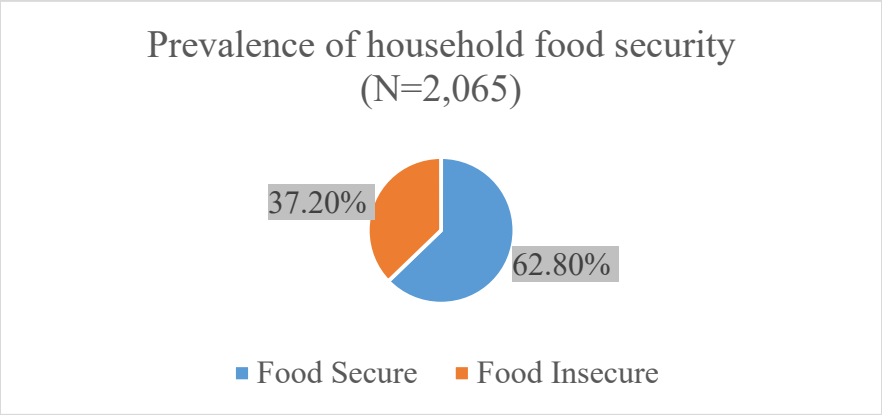

Figure 2 *Prevalence of household food security (N=2,065)*

3. Factors affecting food security: A multivariate analysis

Hierarchical binary logistic regression analysis was used to examine the factors associated with food security. The model included variables such as age, race, religion, education level, occupation, food waste behaviour, food planning routines and social cohesion. The model produced a good fit with chi-squared value of 10.45 (p= .235). Nevertheless, Nagelkerke R^2 indicates that only 5.5% of the variation in household food security is explained by the model. This highlights the complexity of food security, which may involve additional unmeasured factors.

The analysis revealed that ethnic groups and food planning routines could increase the odds of being food insecure. The Dayak group had higher odds of food insecurity compared to the non-Dayak group (AOR=1.40; 95% CI: 1.01, 1.95). Next, for every increase in food planning routines, the odds of food insecurity increased by 0.27.

The analysis also showed that age, religion, education, and social cohesion could reduce the odds of being food insecure. For every one-year increase in age, the odds of being food-insecure were reduced by 2% (AOR=0.98; 95% CI: 0.97, 0.99). In terms of religion, Buddhism and Atheism can reduce food insecurity by 63% when compared to Islam (AOR=0.37; 95% CI: 0.21, 0.61). Having secondary and tertiary education could reduce the odds of being food-insecure by 31% and 67%, respectively, compared to having no formal education (secondary education: AOR=0.69; 95% CI: 0.49, 0.97; tertiary education: AOR=0.33; 95% CI: 0.21, 0.52). Finally, for every one-point increase in social cohesion, the odds of being food-insecure were reduced by 11% (AOR=0.89; 95% CI: 0.81, 0.97).

Table 2 Factors affecting household food security: Hierarchical binary logistic regression analysis (N=2,065)

Model	B	SE	AOR	95% CI for B	
				LL	UL
Constant	0.23	.661	1.26		
Age	−0.22	.004	0.98**	0.97	0.99
Race					
Non-Dayak (Ref)			1.00		
Dayak	0.34	.168	1.40*	1.01	1.95
Religion					
Islam (Ref)			1.00		
Christianity	−0.14	.172	0.87	0.62	1.22
Others	−0.98	.291	0.37***	0.21	0.61
Education level					
No formal education (Ref)			1.00		
Primary education	−0.25	.190	0.78	0.54	1.13
Secondary education	−0.38	.176	0.69*	0.49	0.97
Tertiary education	−0.38	.188	0.33***	0.21	0.52
Occupation					
Unemployed (Ref)			1.00		
Employed	0.07	.111	1.07	0.86	1.33
Food Waste Behaviour	−0.12	.148	0.89	0.67	1.19
Food Planning Routines	0.24	.062	1.27***	1.13	1.44
Social Cohesion	−0.12	.048	0.89*	0.81	0.97
Lemeshow Test	10.45 (8), p=.235				
Nagelkerke R Square	0.055				
Cox & Snell R Square	0.041				
N	2,065				

*p < .05, **p < .01, ***p < .001

B=Beta coefficient SE=Standard error AOR=Adjusted odds ratio Ref=Reference category LL=Lower limit of 95% confidence interval UL=Upper limit of 95% confidence interval

AOR >1 indicates an increased likelihood of food insecurity; AOR <1 indicates decreased likelihood of food insecurity; AOR =1 indicates no association

Discussion

Our analysis found that 37.2% of the households were food insecure. This finding was higher than the previous research in Sarawak[7] and national study.[8] This might be because our study was performed during the COVID-19 pandemic period in which most households' incomes were affected by the pandemic.[31] As a result, more households became food insecure as these households could not afford to buy food.

The connectedness within the community can be an excellent resource to prevent families from going into poverty, thus protecting them from food insecurity. Our analysis found similar findings for social cohesion with previous studies whereby good social cohesion can reduce household food insecurity.[17, 18, 32] Brisson[18] confirmed that changes in social cohesion over time also change household food security. Policymakers could focus on improving food security by targeting the community instead of the individual household through improving social cohesion. However, in our study, we did not examine how social cohesion led to food security. As such, future research can be conducted to identify the mechanisms behind this relationship.

Contrary to the theoretical explanation, having good food planning routines was found to have higher odds of being food-insecure than being food-secure. The theoretical basis dictates that proper food planning routines allow a person to manage food expenses more effectively and efficiently. In return, it would decrease the quantity of food waste produced, thus improving food security.[11, 12] The opposite phenomenon was instead observed in the current context, with more food-insecure households being better at food planning routines. This situation can be due to the food-insecure households being usually poor.[6, 33, 34] These households needed good food planning to reduce waste and save sufficient money to make ends meet. Thus, this situation may have led to deviation from the aforementioned theory. Future studies can further examine this relationship by conducting longitudinal studies, which can help to prove or reject the finding.

Next, the present study found no significant relationship between food waste behaviour and household food security. This finding differed from Gahamat,[35] who found that food waste behaviour directly affected household food security. One major reason that might contribute to the lack of significant difference between these two household groups in their food waste behaviour was the COVID-19 pandemic. Most households' incomes were affected by the Movement Control Order (MCO) imposed by the Malaysian government during the pandemic.[31] As such, all households, regardless of being food-secure or food-insecure, had to reduce food

waste in their respective household to save money. Thus, this led to the food-secure and food-insecure households having similar food waste behaviour. Nevertheless, future research could investigate this relationship once the pandemic situation has stabilised, and the economic status has improved.

Several limitations were identified in this study. Firstly, the present study was conducted using a cross-sectional study design. Independent and dependent variables were measured in the same timeframe. As such, cause-and-effect relationship between variables could not be established. Secondly, some respondents may have answered all the questions without going into depth, which can affect the study's outcome.[36] Third, the data were collected via face-to-face interview, which may be subjected to interviewer bias. Forth, this research only obtains information from single respondents per household, which may not capture household-wide perspectives on food security. Finally, the findings from the current study might be impractical to other states in Malaysia due to cultural differences.

Conclusion

The present findings have enhanced the current body of knowledge regarding household food security among Sarawak households. We found that young age, secondary and above education, good food planning routine, and social cohesion appeared to be potential predictors of household food security. Long-term programmes focusing on reducing food insecurity would be effective by promoting social cohesion among the public.

Ethical Approval Statement

Participation in this study was voluntary, and respondents' personal information and identities were kept confidential. The Medical Ethics Committee approved this study (Reference no.: FME/21/65).

Author Contributions

Rahman conceived and designed the analysis, provided revisions to scientific content as well as stylistic and grammatical revisions of the manuscript. Wong collected the data, contributed data, performed the analysis, and wrote the paper. All authors read and approved the final manuscript.

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Conflicts of Interest

The authors declare no potential conflict of interest.

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