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Characteristics of individuals at risk of malnutrition in Thailand: an investigation focusing on income insecurity

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Without understanding the characteristics of disadvantaged individuals who are at risk of malnutrition, it is impossible for policymakers to develop and implement effective policies to combat malnourishment among individuals facing income insecurity. With an accurate picture of who is at the greatest risk, policymakers will be able to target the most vulnerable population and develop interventions tailored to their needs. However, there is a dearth of research in Thailand which presents such characteristics and makes it more difficult to design appropriate policy interventions. This study we applied a logit regression model on data collected by Food and Agriculture Organization (FAO) in 2021 ($n = 981$). The findings of this study indicate that gender, age, place of residence, educational attainment, and family composition are all strong predictors of access to adequate nutrition among those who are financially disadvantaged. Specifically, we observed that women aged 30–44 years old are 11.5% more likely to not have access to adequate nutrition due to financial constraints compared to those aged 18–29 years old. In consideration of these important predictors, policymakers are recommended to take bold steps including these aforementioned factors while formulating strategies and policy interventions to address malnutrition among the financially disadvantaged.

KEYWORDS

malnutrition, undernourishment, undernutrition, income insecurity, poverty, food security, characteristics, Thailand

1 Introduction

Malnutrition is an ongoing problem for many individuals and families living in financial insecurity that restricted their access to healthy foods and their ability to acquire knowledge about proper nutrition (Bain et al., 2013; Drammeh et al., 2019). The lack of nutritional intake has been shown to have severe repercussions on the physical and psychological health of those affected, such as the increased risk of cancer, mental health disorder, and depression. This intense situation highlights government's intervention that is crucial in not only providing help for those in need (Ihab et al., 2015; Devine and Lawlis, 2019) but in addressing the systemic issues that lead to malnutrition in the first place (Deolalikar, 2005; Huang et al., 2013; Sansón-Rosas et al., 2021).

One of the primary reasons individuals in vulnerable populations suffer from food malnutrition is due to the lack of financial stability. Without secure income streams, they are

unable to afford adequate nutrition to maintain their and their families' health. In some cases, this cyclical poverty results in difficult decisions when it comes to budgeting and ultimately purchasing food. Without an income instability, individuals are more likely to opt for cheaper and less nutritious options, posing a real threat to their health and wellbeing.

Since 2014, the number of undernourished people in Thailand has been steadily rising (Food and Agriculture Organizations, 2021b), greatly impacting the country's economic growth due to its effects on individuals' health and productivity (The Nation, 2018; Tiwasing et al., 2018; Okubo et al., 2020). The COVID-19 pandemic has worsened the situation significantly, pushing an additional 8.8 million people in Thailand towards the brink of undernourishment in 2020, with children and older people in low-income households being the most affected (Mayurasakorn et al., 2020; Shinsugi and Mizumoto, 2022; Vicerra et al., 2022). This increased level of malnutrition presents an imminent challenge that the Thai government needs to address by implementing urgent policies, strategies and interventions, to ensure their citizens lead healthy and productive lives.

Despite the needs to identify and safeguard households in Thailand that are at high risk of being undernourished due to financial insecurity, there is a lack of research on the subject to provide adequate amount of information regarding the characteristics such as age, community, cognitive ability and family arrangements. In search of this, this paper we aim to investigate the characteristics of people who are at risk of malnutrition which results from the lack of financial resources, utilizing data from the survey of Food Insecurity Experience Scale 2021 in Thailand by the United Nation's Food and Agricultural Organization (FAO) (Food and Agriculture Organizations, 2021a).

The results of this analysis are expected to support policies to promote livelihoods and reduce the malnutrition risk of those who are in a financially disadvantaged conditions, especially after the COVID-19 pandemic that has severely affected their wellbeing.

2 Literature review on people at risk of malnutrition from income insecurity

Malnutrition and income insecurity are linked to each other in many ways (Steiber et al., 2015; Paslakis et al., 2021). Malnutrition is often the result of an inability to access adequate and nutritious food which frequently due to conflict, health, seasonal access to natural resources, or even unequal opportunities in all spheres of society, such as education, technology, and work (Rojer et al., 2016; Soeters et al., 2017; Khan, 2023; Luc et al., 2023; Saleem, 2023), while income insecurity is the state of not having enough income to cover basic needs (Young, 2022). This infers that people facing income insecurity are more likely to suffer from malnutrition as they may not have enough money to purchase nutrient-rich food (Painter, 2016; Loopstra, 2018). This issue is exacerbated by the fact that in many countries, the least healthful food options, such as processed foods and sugary drinks, are often cheaper than the healthier options (Monteiro et al., 2010; Popkin and Ng, 2022). In addition, people in low-income households that struggle to make ends meet must choose between purchasing high-quality food and cover other essential costs such as family expenses (Loopstra, 2018; Young, 2022). As a result,

this lack of financial resources increases the risk of malnutrition further as it can lead to a decreased overall food intake and changes in eating habits (Xie et al., 2021).

In addition to income insecurity, other important associated elements are gender, age, place of residence, educational achievement, and family arrangement (El Shikieri, 2023; Kandapan et al., 2023; Sultan and Iram, 2023).

Considering gender influence, within the same households, women and girls often face greater risks of malnutrition due to the perpetuation of gender roles (Hwang and Shon, 2014; Frize et al., 2021). Duties of family works can result in females receiving less access to quality food and nutrition than men and boys. Furthermore, globally, women are more likely to live in poverty than men (Okin, 2015) which mean that women are more likely to experience hardship in accessing the food and nutrition that they need (Ivers and Cullen, 2011; Botreau and Cohen, 2020). In addition, limited access to credit, education, and employment opportunities can leave women especially vulnerable to economic instabilities, further exacerbating their risk of malnutrition (Ngoma and Mayimbo, 2017; Abrahams et al., 2018).

Regarding age, as people grow older, they tend to have more money to spend than younger people. This gives them a better chance of being able to afford nutritious foods, and therefore decreases their risk of malnourishment in comparison to younger people with financial constraints (Imamura et al., 2015; Munt et al., 2017). This is especially true for prepared retirees who may have pension or government benefits to supplement their income, and thus, their food choices may be sufficient for their nutrition needs (Imamura et al., 2015).

In terms of residency, the prevalence of malnutrition varies drastically between urban and rural environments due to income insecurity (Anríquez et al., 2013; Hong et al., 2020). Urban citizens often have to pay higher prices for housing and transportation, leaving them with less disposable income for food, and therefore, more vulnerable to malnutrition (Mohiddin et al., 2012; Tacoli, 2019). In contrast, rural residents are generally able to access cheaper living costs, allowing them to purchase healthier foods. However, in some cases, there may not be a difference in malnutrition levels between urban and rural areas (Meenakshi, 2016; Tacoli, 2019; Mittal and Vollmer, 2020). One reason might be that urban areas often offer various nutritious options at competitive prices (Anríquez et al., 2013; Meenakshi, 2016).

Regarding educational factors, the connection between education achievement and malnutrition is direct and clear. A higher level of schooling leads to better economic opportunities, and hence, allowing individuals to make smarter decisions about their spending and diets (Kramer and Allen, 2015; Damião et al., 2017; Dutta et al., 2019). By having the knowledge on effective financial management and nutrition, those with more education are better equipped to access nutritious foods and less likely to be at risk of undernourishment (Dutta et al., 2019).

Lastly, when looking at profiles of households, a larger family can find themselves more exposed to the risk of malnutrition. For example, families with more members are likely to be disproportionately affected (Mishra et al., 2014; Asim and Nawaz, 2018) because it is more difficult for them to make ends meet and have resources to buy enough food for all (Mishra et al., 2014; Khan and Raza, 2016).

In summation, the individual factors that contribute to the risk of malnutrition are multifaceted, including family structure, age, gender, place of residence, and educational attainment. Such elements are interconnected, and when combined, can create a complex environment that enhances an individual's probability of being malnourished. In the context of Thailand, while existing research acknowledges the multifaceted nature of individual factors contributing to the risk of malnutrition, there remains a notable research gap that requires further exploration. Specifically, there is a need for more in-depth investigations into how the unique socio-cultural and economic landscape of Thailand influences the interconnected dynamics of family structure, age, gender, place of residence, and educational attainment in relation to malnutrition risk. The existing literature provides a foundation by recognizing the complexity of these elements, but a deeper understanding of their interplay within the Thai context is essential for developing targeted interventions and policies.

3 Research design

3.1 Dataset

This study utilized the 2021 Food Insecurity Experience Scale (FIES) survey data from Thailand, collected by the United Nations Food and Agriculture Organization (FAO) Statistics Division via a telephone sample design of 1,033 responses (Food and Agriculture Organizations, 2021a). Unit of analysis is individuals. After filtered the responses taking their comprehensive detail into consideration, 981 data points were deemed applicable to the investigation. The dataset provided information on various demographic variables like the number of adults and children in the household, age, education level, rural or urban area, gender, and income. Moreover, the FIES survey module focused on the respondents' experiences in the past 12 months such as their worries about inadequate food, their inability to access healthy and nutritious food, or their reliance on a limited variety of edibles (Food and Agriculture Organizations, 2021a).

3.2 Empirical model

- Dependent variable

The dependent variable is "UHY," as indicated by the question in the Thailand FIES 2021 dataset inquiring "Were you unable to eat healthy and nutritious food because of lack of money or other resources?" This variable is a dichotomous variable, with "Yes" representing the respondent's experience of being unable to eat healthy and nutritious food due to the lack of money or other resources, and "No" indicating the opposite.

- Independent variables

Six predictor variables, derived from a literature review, were utilized in this study. They were gender (GDR) and area of residence (AOR), which were dichotomous variables. Meanwhile, ordinal variables were number of adults in the household (NAH), number of children in the household (NCH), age (AGE), income of respondent (INC), and education (EDU).

3.3 Model construction

This study utilized logistics model to investigate the characteristics of people who are at risk of malnutrition by considering the characteristics of selected dependent variable, namely, UHY. The logistics regression model (logit) was fundamentally used for analyzing the dichotomous variable. It attempted to estimate the probability of being in one category compared to being in another category (Hosmer et al., 2013).

The estimation method is denoted as follows:

$$P = (UHY_{i,j} = 1) = \frac{e^{\beta X_i}}{\sum_i e^{\beta X_i}} \quad (1)$$

and

$$X_i = \alpha_0 + \beta_2 GDR_i + \beta_1 AGE_i + \beta_2 INC_i + \beta_3 AOR_i + \beta_4 EDU_i + \beta_5 NAH_i + \beta_6 NCH_i$$

where UHY_i is individual respondent i ; $P(UHY = 1)$ is the probability of the individual respondent having an experience of being unable to eat healthy and nutritious food due to the lack of money or other resources; X is defined as a set of independent variables; and β, α is a set of coefficients.

According to Eq. (1), the probability of success event $P(UHY = 1)$ was quantified by β in the set of predictors X . Marginal effect was used to interpret the meaning of β , indicating as the following equation:

$$\text{Marginal Effect: } \frac{\partial \hat{P}}{\partial X} = \hat{\beta}_X \hat{P}(1 - \hat{P}) \quad (2)$$

In Eq. (2), the partial derivative of the probability, $P(UHY = 1)$, with respect to X yielded the marginal effect. A positive sign in the marginal effect indicated that, when the predictor or independent variable increased by one unit, there was an increase in the probability of a successful event of the same magnitude. Conversely, a negative sign in the marginal effect implied that, as the predictor or independent variable increased by one unit, the probability of a failed event decreased by the same magnitude.

3.4 Limitations

This paper focused on investigating how an individual's profile and background could increase their risk of being unable to consume nutritious meals. Unfortunately, our analysis did not include other influential biological and behavioral factors such as dietary and eating preferences, or lifestyle factors. Despite this, our analysis still provides insight into the crucial effects that financial disadvantage could have on malnutrition. Therefore, our research serves to illustrate who is most at risk for malnourishment due to limited access to healthy meals, as well as the socioeconomic components which limit nutrition.

Additionally, while we utilizing cross-sectional data in our research on malnutrition and individual income security, it is essential to acknowledge certain limitations. Especially, cross-sectional data captures

a snapshot at a specific point in time, making it challenging to establish causal relationships between malnutrition and individual income security. Despite these limitations, this static perspective is particularly beneficial for identifying co-occurring patterns and disparities among various demographic groups (Zaman, 2023). Therefore, significant contributions of our study would unveil a deepened understanding of the complex interplay between malnutrition's predictors and individual income security in the given temporal snapshot.

4 Results

4.1 Descriptive statistics

Table 1 presents data of 981 respondents from the 2021 Food Insecurity Experience Scale (FIES) survey conducted by the United Nation's Food and Agriculture Organization (FAO) Statistics Division in Thailand, comprising 438 males and 543 females. Results showed that 190 female respondents had experienced being unable to consume nutritional food due to the lack of financial resources, compared to 101 male respondents. It was noteworthy that females in Bangkok had a higher risk of undernourishment than males, with ratios of 0.54 and 0.30, respectively. In terms of residence areas, people who live in rural areas were more likely to be malnourished as compared to those in urban areas (ratio Rural 0.53 > Urban 0.34).

Regarding age, it was discovered that the risk of malnutrition among Thai people did not rise with age. 52% of those aged between 18 and 29 experienced malnutrition due to a lack of financial resources, while that of those over 60 years of age decreased to 18%. This was mirrored by the income quintile as the ratio of malnourishment dropped from 1.43 among the poorest to 0.18 among the richest. This suggested that the risk of malnutrition in Thailand was heavily connected to the lack of financial resources.

Upon further examination of educational attainment, a startling trend appears. Specifically, the ratio of individuals who have only completed elementary school to those at risk of malnutrition is surrounding one (ratio = 1.04). This appeared that the majority of individuals with only an elementary school education have faced difficulty to consume a healthy food due to limited financial resources.

Regarding family arrangement, it was observed that bigger families were at a greater risk of undernourishment compared to smaller ones. The data revealed that only 38% of families with no children were exposed to the risk of being unable to access healthy food due to financial constraints. Conversely, this figure rises to 41, 59, and 67%, respectively, for families that had 1, 2, and 3 or more children, respectively.

4.2 Empirical results

Results of analyses of data from the survey, conducted with calculation methods described in the Section 3.2, are presented in Table 2. Regarding the relation between gender and experience of being unable to eat healthy food due to lack of financial resources, the female respondents had a significantly higher probability of facing this problem than male respondents (probability of 7.1%). This suggested that gender was a significant predictor of experiencing difficulty in eating healthy food due to financial constraints.

TABLE 1 Descriptive statistics of used dataset of the 2021 food insecurity experience scale (FIES).

Variables	Individuals who are unable to eat healthy and nutritious food due to lack of financial resources (UHY)			
	No	Yes	Total	Ratio (Yes/No)
<i>Gender (GDR)</i>				
Male	337	101	438	0.3
Female	353	190	543	0.54
<i>Age of respondents (AGE)</i>				
18–29 years old	148	77	225	0.52
30–44 years old	303	132	435	0.44
45–59 years old	188	73	261	0.39
60 years old and above	51	9	60	0.18
<i>Income quintile (INC)</i>				
Poorest_20%	40	57	97	1.43
Second_20%	56	59	115	1.05
Middle_20%	99	76	175	0.77
Fourth_20%	157	56	213	0.36
Richest_20%	338	43	381	0.13
<i>Area of residence (AOR)</i>				
Urban/Suburb	402	138	540	0.34
Towns/Rural	288	153	441	0.53
<i>Education (EDU)</i>				
Elementary	75	78	153	1.04
Secondary	143	104	247	0.73
College	464	106	570	0.23
Not specified	8	3	11	0.38
<i>No. of adults 15 years of age and above in household (NAH)</i>				
1	145	49	194	0.34
2	173	78	251	0.45
3	128	59	187	0.46
4	124	49	173	0.4
5 people and above	120	56	176	0.47
<i>No. of children under 15 years of age in household (NCH)</i>				
0	450	171	621	0.38
1	133	54	187	0.41
2	74	44	118	0.59
3 children and above	33	22	55	0.67
Total observation = 981 respondents				

The 2021 Food Insecurity Experience Scale (FIES), the United Nation's Food and Agriculture Organization (FAO) Statistics Division in Thailand.

In regard to age, it was revealed that people aged 60 years old and above are significantly less likely to experience difficulties with accessing healthy food when compared to individuals aged 18–29 years old, with a risk reduction of about 19%. This result highlights the connection between age and the ability to afford nutritious food.

TABLE 2 Factors influencing risks of malnutrition due to income insecurity in Thailand.

Independent variables	Prob (UHY = 1)		
	mfx	S.E	p-value
<i>Gender (GDR)</i>			
Male (based value)			
Female	0.071	0.030	0.016**
<i>Age of respondents (AGE)</i>			
18–29 years old (based value)			
30–44 years old	0.011	0.037	0.774
45–59 years old	–0.062	0.038	0.108
60 years old and above	–0.194	0.034	0.000**
<i>Income quintile (INC)</i>			
Poorest_20% (based value)			
Second_20%	–0.040	0.051	0.432
Middle_20%	–0.076	0.045	0.091*
Fourth_20%	–0.192	0.037	0.000**
Richest_20%	–0.363	0.043	0.000**
<i>Area of residence (AOR)</i>			
Urban/Suburb (based value)			
Towns/Rural	0.003	0.030	0.934
<i>Education (EDU)</i>			
Elementary	0.197	0.054	0.000**
Secondary	0.112	0.039	0.005**
College (based value)			
<i>No. of adults 15 years of age and above in household (NAH)</i>			
1 (based value)			
2	–0.019	0.046	0.684
3	–0.064	0.045	0.155
4	–0.057	0.047	0.230
5 people and above	–0.086	0.045	0.055*
<i>No. of children under 15 years of age in household (NCH)</i>			
0 (based value)			
1	–0.047	0.037	0.196
2	–0.033	0.044	0.444
3 children and above	–0.047	0.057	0.412
Total observation = 981 respondents			

mfx, marginal effect; *, ** = significance at level 0.1 and 0.05, respectively.

When taking income quintiles into consideration, the findings suggested that individuals in the fourth to richest quintiles experienced significantly lower risks of 19.2 and 36.3% when compared to those in the poorest quintile. No significant differences were observed when comparing the second quintile to the poorest quintile, however, suggesting that people in these quintiles are likely to face similar issues.

Moreover, this study also found that where an individual resides made no significant difference in their risk of being unable to eat healthy food due to financial shortages. There were no significant findings regarding the impact of rural or urban areas on this issue.

More importantly, the effects of education level on risk of malnutrition were significant. At the 0.05 level of significance, individuals

who had only received elementary education were 19.7% more likely to have malnutrition compared to those with college degrees. This risk decreased to 11.2% for those with a secondary school diploma.

As the number of family members increased, the probability of people exposed to the risk of malnutrition has increased significantly at a level of 0.10. Results showed that families with more than four adult members had a higher risk at 8.6% of not being able to eat healthy food due to financial limitations compared to families with only one adult. However, there was no significant correlation found between the risk and the total number of children in the family.

5 Discussion

The risk of malnutrition in regard to financial insecurity among individuals can differ based on their background and environment. In terms of gender, we can support that women were found to be at a particularly elevated risk of facing financial restrictions that can limit their access to quality food. This might be due to their extra responsibility for family work. This limits the amount of time and energy a woman has to pursue nutritional items that promote their health (Hwang and Shon, 2014; Frize et al., 2021).

Regarding age, the findings found that age does not play a large role in determining the risk of being unable to eat healthy food due to financial shortage; however, those aged 60 and over significantly face a 24.3% lower risk of not having enough money to purchase nutritious foods than younger populations aged 18 to 30. It is likely due to aged-wealth accumulation (Imamura et al., 2015; Munt et al., 2017). Thai older people tend to have more money to spend than younger people, enabling them to purchase better-quality and more nutritious food. A possible explanation for this could be that many older individuals have financial means in form of pensions, government benefits, or other retirement sources that they can use to supplement their income, thus allowing for improved food choices that meet their nutritional needs.

Further discussion, we found no strong association between living in either urban or rural areas and an inability to access healthy food due to financial constraints. This indicated similar levels of malnutrition regardless of the area's geographic location which were in line with global studies (Meenakshi, 2016; Tacoli, 2019; Mittal and Vollmer, 2020). Affordable, nutritious options can be found in urban environments; however, the prevalence of malnutrition varies according to one's income security and costs of food choices (Anriquez et al., 2013; Meenakshi, 2016; Hong et al., 2020). Therefore, the access to healthy food ultimately depends on one's monetary capability (Painter, 2016; Loopstra, 2018). Regarding educational factors, the link between educational attainment and malnutrition was unambiguous. Thais with higher levels of education were supposed to have greater access to economic resources that could allow them to make appropriate choices regarding their diets and expenses (Kramer and Allen, 2015; Damião et al., 2017; Dutta et al., 2019).

Lastly, when examining profiles of households, Thai families with more adults are likely to expose to higher risk of malnutrition due to the strain it puts on their resources to buy food, as there are more people to feed, making it both more expensive and scarce in terms of access to nutritious food (Mishra et al., 2014; Asim and Nawaz, 2018). Curiously, when it comes to the number of children in the family, this was not found to be a predictive factor in malnutrition. This could suggest that Thai children may be eating the same food as their parents, which lessens the financial burden of buying food choices (Wang et al., 2011).

6 Concluding remark

This study we could identify the groups of Thais who were most at risk of malnutrition due to financial hardship. Despite not including other influential biological and behavioral aspects of eating, our analyses still revealed the significant relationship between one's profile and background of those facing income insecurity such gender, age, place of residence, educational achievement, and family arrangement and the probability of them being malnourished.

Policymakers should take bold steps to rectify the concerning situation of malnutrition among those facing financial insecurity, by taking into account the aforementioned factors while formulating strategies and policy interventions. In the short term, policymakers should focus on implementing targeted nutritional assistance programs and subsidy initiatives to provide immediate relief to those facing financial insecurity. This may include the distribution of food vouchers, nutrition education campaigns, and collaborations with local community organizations to ensure that essential nutritional needs are met promptly. For the mid-term to long-term, policymakers should consider interventions that address the root causes of malnutrition among financially insecure populations. This may involve the development of skill-building programs and vocational training opportunities to enhance employment prospects and income stability.

In addition, future studies, where panel data available, should explore on assessing the effectiveness of implemented policies and interventions over time. The study may analyse the evolving socio-economic landscape and its impact on malnutrition, providing policymakers with updated information to adapt strategies accordingly.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author. Dataset can be downloaded upon request at <https://microdata.fao.org/index.php/catalog/2200/study-description>.

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Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

Author contributions

WP: Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft. PB: Conceptualization, Project administration, Supervision, Validation, Writing – review & editing.

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Conflict of interest

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