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RESEARCH ARTICLE

Nutritious Rice Consumption among Urban Consumers in Naypyitaw, Myanmar

Chan Myae Lwin [1,2], Orachos Napasintuwong [1*], Suwanna Praneetvatakul [1]

[1] Department of Agricultural and Resource Economics, Faculty of Economics, Kasetsart University, Bangkok 10900, Thailand

[2] Department of Agricultural Research, Ministry of Agriculture, Livestock and Irrigation, Naypyitaw, Myanmar

ABSTRACT

Myanmar faces considerable nutrition challenges, including high rates of anemia, stunting, and wasting, alongside a growing prevalence of non-communicable diseases. Given the country's high per capita rice consumption, nutritious rice offers a culturally compatible intervention to address these issues. This study investigates the factors associated with choices of nutritious rice among consumers in Naypyitaw, Myanmar. Data were collected from 481 participants and analyzed using a binomial logit model. Results indicate that only 17% of consumers have chosen nutritious rice in the past three years. Higher education levels, increased income, presence of health-vulnerable household members, and positive health behaviors—such as regular exercise, higher fruit intake, and attention to nutritional labeling—were found to significantly increase the likelihood of nutritious rice consumption. Conversely, perceived barriers related to availability and affordability significantly hinder consumption. Findings underscore the need for improvements in consumer knowledge and awareness of health benefits of nutritious rice, as well as policies supporting increased affordability and accessibility, to foster greater consumption and improve dietary health in Myanmar.

Keywords: Random Utility Theory; Healthy Diet; Dietary Choice; Nutrition; Consumer Preference

*CORRESPONDING AUTHOR:
Orachos Napasintuwong, Department of Agricultural and Resource Economics, Faculty of Economics, Kasetsart University, Bangkok 10900, Thailand; Email: orachos.n@ku.ac.th

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1. Introduction

In alignment with the 2030 Agenda for Sustainable Development, countries worldwide are prioritizing Sustainable Development Goals (SDGs) within their national development plans. A key objective, particularly for developing nations, is SDG 2: ending hunger, achieving food security and improving nutrition. Malnutrition remains a critical issue, especially in Africa and Asia, where over half of the world's undernourished population resides [1]. In Southeast Asia, Myanmar faces serious nutrition security challenges, with the highest regional prevalence of undernourishment at 29% (2004–2006) [2]. Myanmar also exhibits notably high rates of non-communicable diseases such as diabetes, which rose from 8.1% in 2004 to 10.5% in 2014, alongside obesity and hypertension, which are more prevalent in urban areas [3–5].

Recent political instability has exacerbated health and nutrition challenges in Myanmar starting 2021. Food price inflation surged from 7% in May 2021 to 41% in March 2022, heavily driven by increased prices of nutrient-rich foods like pulses, animal-based products, fruits, and vegetables [6, 7]. Rice, the staple food for Myanmar's population, has also seen significant price increases, impacting economic access to rice [8]. Consequently, the percentage of population unable to afford healthy diet rose from 47.8% in 2017 to 56.3% in 2022. Indicators of nutritional deficiencies, including anemia among women (39.4% in 2012 to 42.1% in 2019) and adult obesity (5.2% in 2012 to 7.4% in 2022), have escalated [2].

In Myanmar, rice consumption is exceptionally high, averaging 155.14 kg per capita annually (425.04 g per day) [9]. While rice remains a primary energy source, consumption patterns, particularly among urban consumers, show a gradual shift from staple rice toward more diverse food options such as vegetables, fruits and meats [10]. The urban market offers a wide array of rice varieties, including popular types like Paw San, Ayar Min, and Manaw Thuka [9], along with a selection of healthier alternatives such as fortified, unpolished, Riceberry, and parboiled rice. The nutritious rice varieties, enriched with vitamins, minerals, and other health benefits, are marketed as preferable options over traditional polished white rice [11–14]. **Table 1** describes various nutritious rice types available in Myanmar. Fortified rice, enriched with vitamins and minerals, is sold in high-quality (Paw San) and standard (Emata) forms. Low Glycemic Index (GI) rice benefits diabetic consumers, while Riceberry offers antioxidants, and parboiled rice has higher fiber and minerals. Among these, Riceberry is the most expensive, followed by fortified Paw San, unpolished low GI rice, and standard Emata as the least expensive.

Urban consumers in Myanmar are expected to have greater nutritional knowledge and access to information through advertisements and marketing campaigns. Previous studies indicate that urban consumers in Asia increasingly prioritize nutritious rice options over traditional varieties [15, 16]. However, research on consumer behavior regarding nutritious rice in Myanmar is limited. Understanding urban consumers' preferences in Naypyitaw, Myanmar's capital, is especially important, as the city exhibits high rates of malnutrition, with stunting at 24.5%, underweight at 19.4%, and wasting at 6.3% among children, and anemia among women of reproductive age at 33.5% [17, 18].

This study aims to identify the factors associated with urban consumers' choices of nutritious rice products in Naypyitaw. The findings are expected to offer policy insights to promote nutritious rice consumption and improve dietary health in Myanmar, an urgent priority for sustainable development.

2. Theoretical Framework

This study utilizes random utility theory to model the decision-making process of consumers when selecting rice varieties. The theory posits that individuals act as rational decision-makers, seeking to maximize their utility based on their choices. However, since utility is not directly observable, it comprises both a deterministic component and a stochastic error term. The utility derived from consuming rice can be represented through a linear random utility model, as shown in Equation (1) [24]:

$$U_i = \beta_i X_i + \varepsilon_i \quad (1)$$

Table 1. Characteristics of rice varieties marketed in Naypyitaw, Myanmar.

Characteristics	Regular Rice (Paw San)	Regular Rice (Emata)	Fortified Rice (Paw San)	Fortified Rice (Emata)	Unpolished Rice (High-Grade)	Unpolished Rice (Paw San)	Riceberry	Parboiled Rice
Type of rice	Medium and round grain	Thin and slender long grain	Medium and round grain	Thin and slender long grain	Long slender grain	Medium and round grain	Long slender grain	Long slender grain
Aroma	Aromatic	-	Aromatic	-	-	-	Aromatic	-
Color	White	White	White	White	Brown	Brown	Dark purple	Yellow
Key nutrients	Carbohydrate, Fat		Carbohydrate, Fat, Iron, Zinc, Niacin, Vitamin A, Folic acid, Vitamins B1, B6, B12		Carbohydrate, Fat, Dietary fiber, Iron, Potassium		Carbohydrate, Fat, Dietary fiber, Vitamin B1, Iron	Carbohydrate, Fat, Dietary fiber, Iron, Potassium
Market price (MMK/kg)	3,800	2,500	4,500	2,650	4,500	3,800	6,000	3,300
Photo of rice								

Sources:
Key nutrients listed for each type of rice and product photos are sourced from marketed products in Naypyitaw and official webpages of trading companies, including Mya Fortified Rice [19], Myan San Riceberry [20], The Little Rice Company Myanmar [21], Theingi Rice [22].
Market prices are based on the reference prices set by the Department of Consumer Affairs [23]. Although our survey was conducted in 2023, the market price data is from 2024.
Note:
Paw San is a high-quality rice variety, while Emata includes a group of rice varieties that fall under the normal quality grade.

In this equation: U_i represents the utility for the *i*th consumer, β_i denotes the parameters reflecting the influence of various factors, X_i encompasses the factors impacting the consumer's rice choice, ε_i is the stochastic error term that accounts for unobserved influences on utility.

To differentiate between the utilities associated with consuming nutritious rice and not consuming it, we define:

$$U_i^N = \beta_i^N X_i + \varepsilon_i^N \quad (2a)$$

$$U_i^W = \beta_i^W X_i + \varepsilon_i^W \quad (2b)$$

Where: U_i^N is the utility from consuming nutritious rice, U_i^W is the utility from not consuming nutritious rice. The consumer will choose nutritious rice if the utility from consumption exceeds that of non-consumption, formalized as: $U_i^N > U_i^W$ or $y* > 0$. Conversely, the consumer will not choose nutritious rice if: $U_i^N \leq U_i^W$ or $y* \leq 0$. The difference in utility, denoted as y^*, is calculated as follows:

$$y* = U_i^N - U_i^W = (\beta_i^N X_i^N + \varepsilon_i^N) - (\beta_i^W X_i^W + \varepsilon_i^W) = \beta_i X_i + \varepsilon_i \quad (3)$$

Given that net utility (y^*) cannot be directly observed, we derive observable choices based on this model: The consumer opts for nutritious rice (denoted as ($y = 1$) if $y^* > 0$). The consumer refrains from choosing nutritious rice (denoted as ($y = 0$) if $y^* \leq 0$).

This study also adopts Behavioral Perspective Model (BPM) [25]. BPM views consumer decisions not as purely rational, but as being influenced by a range of contextual factors and past experiences, which guide future choices. Consumer behavior is an ongoing process where stimuli in the environment elicit responses (behaviors), which are then reinforced or discouraged based on their outcomes. These decisions are influenced by a mix of environmental stimuli (e.g., the availability and affordability of nutritious rice, the presence of vulnerable household members such as children or the elderly), individual learning (e.g., nutritional knowledge, education level), and reinforcement (e.g., beliefs in the health benefits of nutritious rice, as well as the health outcomes or satisfaction derived from adopting healthy behaviors, such as regular exercise). Health belief Model (HBM) has been adopted in several studies on nutrition dietary behavior [26]. The HBM is a psychological model that explains and predicts health-related behaviors by suggesting that an individual's attitude influences health-related behavior and perception; thus, changing consumers' attitudes and beliefs will lead to preventive health behavior. Furthermore, from nutrition and health perspectives, food literacy, nutrition literacy and health literacy have play a role in dietary decision-making [27]. The literacy in food, nutrition and health are knowledge, skills and information obtained to make connection between health, nutrition and food

choices. By integrating the BPM, HBM and food literacy, nutrition literacy and health literacy into framework of decision making of rice choices, we aim to gain a deeper understanding of the psychological and behavioural mechanisms that drive consumers' decisions to choose nutritious rice.

3. Methodology

This section outlines the sampling design, data collection procedure, and empirical model and estimation used in this study.

3.1. Sampling Design and Data Collection

Data were collected through face-to-face interviews using a structured questionnaire with a total of 481 rice consumers between September and October 2023 in Naypyitaw, the administrative capital of Myanmar. Consumers were randomly selected, but only those willing to participate were included in the study. The study focused on four of the eight townships in Naypyitaw—Zabuthiri, Pyinmana, Pobbathiri, and Zeyarthiri—which were selected based on their high proportions of urban population.

The sampling procedure aimed to ensure a diverse representation of consumers across different income groups, particularly households with children under five years old. This focus on households with young children was important due to the prevalent use of fortified rice as a nutritional supplement for infants in Myanmar, which varies by household income and purchasing behavior. To capture this diversity, participants were approached in a variety of settings, including open markets, modern trade stores, and preschools/playgrounds. Samples were allocated proportionally across the selected townships based on their respective urban populations (**Table 2**). Specifically, Zabuthiri Township, having the largest urban population, accounted for 41% of the total sample, resulting in 197 participants from this area. The distribution continued with 136 participants (approximately 28% of the total sample) from Pyinmana, 84 participants (about 17%) from Pobbathiri, and 64 participants (around 14%) from Zeyarthiri Township. Each township's sample was evenly distributed across three distinct locations: open markets, modern trade stores, and preschools/playgrounds, ensuring a comprehensive representation of consumer behavior regarding rice consumption.

Table 2. Distribution of respondents by township and market type.

Township	Urban Population [a]	Percent of Population	Market Places (Number of Respondents)				Percent of Respondent
			Open Market	Modern Trade Store	Preschool/ Playground	Total	
Zabuthiri	104,596	41%	68	64	64	197	41%
Pyinmana	72,010	28%	48	44	44	136	28%
Pobbathiri	44,437	17%	28	28	28	84	17%
Zeyarthiri	35,106	14%	24	20	20	64	14%
Total	256,149	100%	168	156	156	481	100%

[a] Source: Department of Population [28].

3.2. Empirical Model and Estimation

To analyze consumer choices regarding rice, this study employs a binary logistic regression model. The binary response variable y is defined as follows: y = 1 if the consumer chooses to consume nutritious rice, and y = 0 otherwise. The probability of y = 1 is denoted by P, and the function for y can be expressed as:

$$f(y) = P^y(1-P)^{1-y}, y = 0, 1 \quad (4)$$

The model utilizes maximum likelihood estimation (MLE) to compute the regression parameters. The basic form of the logit model is given by:

$$\begin{gathered} \text{Prob}(y_i = 1) = P_i = \frac{1}{1+e^{-z_i}}, \\ where\ z_i = \beta_0 + \sum_{j=1}^{15} \beta_{ij} X_{ij} + \varepsilon_i \end{gathered} \quad (5)$$

The probability of y_i = 0 is calculated as:

$$Prob(y_i = 0) = 1 - P_i = 1 - \frac{1}{1+e^{-z_i}} = \frac{1}{1+e^{z_i}} \quad (6)$$

In this equation,

- P_i represents the probability of consumer *i* choosing nutritious rice;
- β_0 is the intercept;
- β_{ij} denotes the regression coefficient for influencing factor *j* in sample *i*;
- X_{ij} is the explanatory variable corresponding to factor *j*; and
- ε_i is the error term.

In the case where P_i is strictly between 0 and 1, the logistic distribution is characterized by *(y) =* $ln\left(\frac{P_i}{1-P_i}\right)$. The odds ratio is calculated as:

$$\text{Odds Ratio} = \frac{P_i}{1-P_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \tag{7}$$

The logit (y) model can then be expressed as:

$$\begin{aligned} \text{Logit}(y) &= ln\left(\frac{P_i}{1-P_i}\right) = lne^{z_i} \\ &= \beta_0 + \sum_{j=1}^{15} \beta_{ij} X_{ij} + \varepsilon_i \end{aligned} \tag{8}$$

Here, the logit function is linear in X and in the parameters from an estimation perspective. A detailed description of the dependent and independent variables used in the model is presented in **Table 3**. These explanatory variables are included given hypotheses based upon theoretical frameworks mentioned above. Specifically, AGE, GENDER, HHSIZE, CHILD, ELDER, INCOME, EXER, VEG, FRUITS, AVAIL, AFFORD from BPM; BELIEF from HBM and KNWL from nutrition and health literacy. Their expected signs are summarized in **Table 3**.

The marginal effect at a specific value of $X_{ij}$is computed as:

$$\frac{\partial P_i}{\partial X_{ij}} = \beta_{ij}\left[P_i\left(1-P_i\right)\right] \tag{9}$$

For continuous variables, this marginal effect represents the change in the probability of consuming nutritious rice for a one-unit increase in X_{ij}. For dummy variables, the marginal effect is calculated by comparing the predicted probability when X_{ij} = 1 to when X_{ij} = 0. It represents the discrete change in probability associated with moving from X_{ij} = 0 to X_{ij} =1, rather than a small continuous change.

Table 3. Description of Variables in the Binomial Logit Model.

Variable	Description	Unit of Measurement	Expected Sign
y	Indicates whether the respondent is currently consuming or has consumed any type of nutritious rice, including fortified, unpolished. Riceberry, or parboiled rice, within the past three years. This variable captures the decision to consumer healthier rice options.	=1 for nutritious rice consumption, 0 otherwise	N/A
AGE	Age of the respondent	Years	+/-
GEN	Gender of the respondent	=1 for female, 0 otherwise	+/-
EDU	Number of years of schooling completed by the respondent	Years	+
HHSIZE	Number of individuals living in the respondent's household, who share meals and expenses for at least six months	Number	+/-
CHILD	Indicates the presence of children in the respondent's household	=1 for presence of children, 0 otherwise	+
ELDER	Indicates the presence of elderly members in the respondent's household	=1 for presence of elderly member, 0 otherwise	+
INCOME	Monthly income of the respondent's household	Million MMK (Myanmar Kyat)	+
KNWL *	A knowledge assessment score derived from five questions regarding essential nutrients relevant to the general population and fortified rice. Each correct answer earns 1 point, yielding a maximum score of 5 points, thereby assessing the respondent's nutritional knowledge.	Numeric score	+
EXER	Number of weekly exercise hours.	=1 for meeting exercise recommendation (150 minutes per week), 0 otherwise	+
VEG	Number of days per week the respondent consumes vegetables.	Days	+
FRT	Number of days per week the respondent consumes fruits.	Days	+

Table 3. *Cont.*

Variable	Description	Unit of Measurement	Expected Sign
LABEL	Indicates whether the respondent reads nutritional content labels.	=1 for reading labels, 0 otherwise	+
AVAIL	A perception measure regarding the availability of nutritious rice: "It is not easy to buy nutritious rice."	5 = strongly disagree, 4 = somewhat disagree, 3 = undecided, 2 = somewhat agree, 1 = strongly agree	-
AFFORD	A perception measure concerning the affordability of nutritious rice: "It is too difficult to frequently consume nutritious rice as the price is relatively higher than normal white rice."	5 = strongly disagree, 4 = somewhat disagree, 3 = undecided, 2 = somewhat agree, 1 = strongly agree	-
BELIEF **	A perception measure of health benefit of nutritious rice: "Consuming nutritious rice would protect me from getting anemia."	1 = strongly disagree, 2 = somewhat disagree, 3 = undecided, 4 = somewhat agree, 5 = strongly agree	+

* Nutritional Knowledge Assessment Questions:
1. Which nutrient helps with vision?
2. Which of the following nutrients are essential for the development and proper functioning of the brain?
3. Which of the following nutrient is essential for immune system?
4. Which nutrient helps prevent birth defects?
5. Which of the following nutrient is important in the prevention of anemia?
The correct answers are based on the statements included in the technical guidance book for rice fortification by the Ministry of Health and Sports [12].
** Since nutrients of different nutritious rice in the market are different but iron is common (except for parboiled rice), we include health belief of benefit from iron which is the prevention of anemia.

4. Results and Discussion

This section explores the consumption behavior of rice consumers in Naypyitaw, the capital of Myanmar, with a focus on the types of nutritious rice consumed among diverse socio-demographic groups. It will also discuss the factors associated with the likelihood of consuming nutritious rice, including socioeconomic status, nutritional awareness, and health-related behaviours.

4.1. Types of Nutritious Rice Consumed

Despite efforts to capture a broad demographic for comparing consumers of nutritious rice with those of regular rice, the findings indicate that only 80 out of 481 respondents (17% of the total sample) reported consuming nutritious rice. Among these respondents, 18 individuals (4% of the total sample) are current consumers, while 62 individuals (13% of the total sample) indicated they have tried nutritious rice at some point in the past three years.

Fortified rice emerged as the most popular choice among nutritious rice consumers, constituting 62% of this subgroup (**Figure 1**). This high consumption rate can be attributed to several initiatives led by organizations such as the Ministry of Health and Sports (MoHS), the Ministry of Social Welfare, Relief and Resettlement (MSWRR), the Livelihoods and Food Security Fund (LIFT), the Program for Appropriate Technology in Health (PATH), and the World Food Programme (WFP). These organizations have implemented various activities, including providing technical assistance to fortified rice producers, integrating fortified rice into school lunch programs, distributing fortified rice to vulnerable populations, and promoting its consumption [29, 30].

Following fortified rice, unpolished rice is the second most commonly consumed type, accounting for 32% of respondents. In contrast, Riceberry, recognized for its health benefits, is consumed by only 4% of respondents, while parboiled rice has the lowest consumption rate, with only 2% of participants having tried it. The limited consumption of nutritious rice is mirrored by a low level of awareness about these products. Specifically, parboiled rice and Riceberry have recognition rates of only 24% and 22%, respectively. In comparison, unpolished rice is the most recognized variety, with 71% of respondents reporting familiarity, while fortified rice follows closely, with 57% awareness among participants. This disparity highlights the challenges in promoting nutritious rice options and the need for targeted awareness campaigns to enhance consumer knowledge and acceptance.

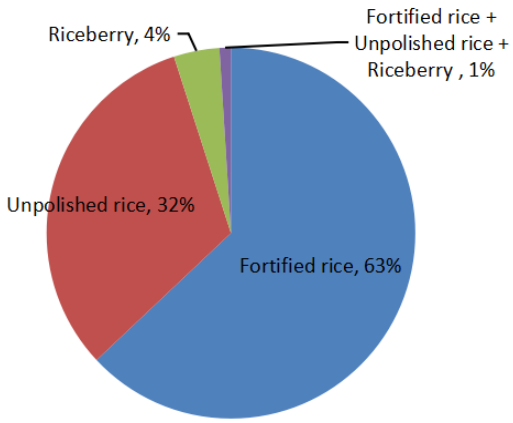

Figure 1. Type of nutritious rice consumed by the respondents in Naypyitaw, Myanmar, 2023 (n = 80).

Source: Survey data, 2023.

4.2. Socio-Demographic Characteristics of Rice Consumers

Nutritious rice consumers tend to be younger, more educated, and have better income sources compared to regular rice consumers. This demographic group often supports vulnerable household members, including children, the elderly, and individuals with health issues (**Table 4**). The correlation between higher education and the choice to consume nutritious rice suggests that younger consumers may prioritize health and nutrition in their dietary decisions. In contrast, regular rice consumers are generally older, indicating that traditional rice is more prevalent among older generations.

The workforce composition further highlights this distinction. Regular rice consumers are more likely to be unskilled laborers, while nutritious rice consumers often hold positions as government employees, self-employed individuals, or skilled workers, reflecting a higher socioeconomic status. Additionally, the representation of medium- and high-income brackets among nutritious rice consumers suggests a greater financial ability to invest in healthier food options. This trend is also evident in household dynamics, where nutritious rice consumers are more likely to have children and elderly members, pointing to a focus on nutrition for family health. Conversely, regular rice consumers exhibit a lower representation of these vulnerable groups. Notably, households consuming nutritious rice are more likely to include diabetic members, indicating a heightened awareness of health issues and the benefits of dietary choices among these consumers. Overall, these observations reveal significant demographic and health-related characteristics that differentiate nutritious rice consumers from those who prefer regular rice.

4.3. Nutritional Knowledge among Rice Consumers

Nutritional knowledge among urban consumers in Naypyitaw is limited, as demonstrated by a nutritional assessment consisting of five questions about essential nutrients relevant to the general population (**Table 5**). The percentage of correct responses did not differ significantly between regular and nutritious rice consumers, except for questions related to nutrients that help prevent birth defects and anemia. Given that anemia is a pressing issue among women and folic acid supplementation programs for pregnant individuals are still in practice, most respondents displayed better knowledge about these nutrients. However, knowledge regarding other essential nutrients, such as vitamin A, B vitamins, and zinc, was low, with correct answer rates falling below 50%.

4.4. Health-Related Behavior of Rice Consumers

Consumers of nutritious rice demonstrate healthier health-related behaviors compared to those who consume regular rice. The habitual health-related behaviors were hypothesized to influence eating behavior[31, 32]. Our study compared exercise routines, vegetable consumption, fruit intake, and the practice of reading nutritional content labels between the two groups, revealing notable disparities in all behaviors except vegetable consumption (**Table 6**). Interestingly, while regular exercise is relatively uncommon among the Myanmar population, those who engage in physical activity tend to consume nutritious rice more frequently. This suggests that individuals who prioritize exercise may also be more inclined to make healthier dietary choices. In terms of fruit intake, nutritious rice consumers reported significantly higher average consumption, indicating a preference for healthier food options. Furthermore, a substantial pro-

portion of nutritious rice consumers reported regularly reading nutritional labels, reflecting a greater awareness of health and nutrition within this group. This behavior suggests that nutritious rice consumers are more engaged in making informed dietary decisions, likely contributing to their overall health consciousness.

Table 4. Socio-demographic Characteristics of the Respondents in Naypyitaw, Myanmar, 2023.

Characteristics	Number of Sample and Percentage	Respondent Group (%)		Chi-Square	Sig.
		Nutritious Rice	Regular Rice		
Number of respondents	481 (100%)	80 (17%)	401 (83%)		
Gender				0.033	0.856
Male	57 (12%)	11	12		
Female	424 (88%)	89	88		
Age (years)				11.514	0.009
18–25	33 (7%)	3	8		
26–35	177 (37%)	53	34		
35–50	201 (42%)	35	43		
51+	70 (15%)	10	15		
Education level				24.100	0.000
No complete primary	16 (3%)	-	4		
Completed primary school	39 (8%)	1	9		
Completed middle school	105 (22%)	11	24		
Completed high school	72 (15%)	12	15		
Completed bachelor degree	213 (44%)	64	40		
Completed master degree and above	36 (7%)	11	7		
Household Monthly income in million MMK [a]				28.009	0.000
<0.5	202 (42%)	21	46		
0.5–1	185 (38%)	40	38		
>1	94 (20%)	39	16		
Main occupation of household				32.600	0.000
Government staff	176 (37%)	46	35		
Self-employed enterprise	96 (20%)	25	19		
Skilled worker	46 (10%)	19	8		
Unskilled worker	146 (30%)	6	35		
Other	17 (3%)	4	3		
Household size (number)				2.962	0.227
≤2	42 (9%)	5	9		
3–4	252 (52%)	60	51		
≥5	187 (39%)	35	40		
Children household member below 5				9.005	0.003
Yes	233 (48%)	64	45		
No	248 (52%)	36	55		
Elder household member above 60				5.543	0.019
Yes	190 (40%)	51	37		
No	291 (61%)	49	63		
Anemic household member				2.4370	0.119
Yes	85 (18%)	24	16		
No	396 (82%)	76	84		
Diabetes household member				3.8644	0.049
Yes	94 (20%)	27	18		
No	387 (80%)	72	82		

Source: Survey data, 2023; [a] 1USD=2,100 MMK as of September, 2023.

4.5. Perceived Barriers and Benefits to Nutritious Rice Consumption

Perceived barriers and perceived benefits are the strongest predictors of behavioral changes in the health belief model [33]. When comparing two perceived barriers (**Table 7**)—availability and affordability, which are key factors for lower socioeconomic groups [34]—nutritious rice consumers perceive fewer barriers related to both availability and affordability than regular rice consumers. Specifically, nutritious rice consumers express greater confidence in their ability to find nutritious rice, suggesting a higher awareness of where to purchase it. This reduced perception of availability barriers likely contributes to their preference for nutritious rice. Regarding affordability, while nutritious rice consumers do express some uncertainty about costs,

Table 5. Comparison of Nutritional Knowledge Assessment between Nutritious and Regular Rice Consumers in Naypyitaw, Myanmar 2023.

Question	Correct Response (%)			Chi-Square	Sig.
	Nutritious Rice Group (n = 80)	Regular Rice Group (n = 401)	Total (n = 481)		
Nutrient helps with vision	45 (56%)	200 (50%)	245 (51%)	1.085	0.298
Nutrients essential for the development and proper functioning of the brain	28 (35%)	134 (33%)	162 (34%)	0.075	0.784
Nutrient essential for immune system	35 (44%)	137 (34%)	172 (36%)	2.668	0.102
Nutrient helps prevent birth defects	71 (89%)	280 (70%)	351 (73%)	12.111	0.001
Nutrient helps prevent anemia	56 (70%)	286 (71%)	342 (71%)	0.057	0.812

Source: Survey data, 2023.

Table 6. Comparison of Habitual Health-related Behaviors between Nutritious and Regular Rice Consumers in Naypyitaw, Myanmar 2023.

Item	Respondent Group			Chi-Square/t Value	Sig.
	Nutritious Rice (n = 80)	Regular Rice (n = 401)	Total (n = 481)		
Exercise routine				13.354	0.000
Yes	30 (37%)	76 (19%)	106 (22%)		
No	50 (62%)	325 (81%)	375 (78%)		
Average vegetable consumption (days per week)	6.55	6.38	6.41	1.347	0.180
Average fruits consumption (days per week)	5.64	4.84	4.97	3.820	0.000
Reading nutritional content label					
Yes	61 (76%)	232 (58%)	293 (61%)	9.478	0.002
No	19 (24%)	169 (42%)	188 (39%)		

Source: Survey data, 2023.

they generally view price as a less significant barrier compared to regular rice consumers. This implies that, although price remains a concern, nutritious rice consumers are more willing to manage these costs in pursuit of healthier dietary choices. There is no significant difference in the perceived benefits of consuming nutritious rice. The average scores for both groups are above 4, indicating that most respondents in both groups agree on the benefits of consuming nutritious rice.

4.6. Factors Associated with Nutritious Rice Consumption

Multicollinearity, which can distort logistic regression parameters due to linear relationships among explanatory variables [35], was assessed using the Pearson Correlation Matrix and the Variance Inflation Factor (VIF). The analysis revealed that all correlation coefficients were below 0.7, indicating relative independence among the variables. Additionally, the VIF values for all independent variables remained below 5, confirming the absence of significant multicollinearity issues. Consequently, all hypothesized variables were included in the logistic regression analysis, as each may influence the consumption of nutritious rice.

Table 8 presents the estimates of the binary logistic regression regarding the probability of nutritious rice consumption. The results indicate that higher education levels, greater income, and the presence of vulnerable household members are associated with an increased likelihood of consuming nutritious rice. Furthermore, habitual health-related behaviors, such as maintaining an exercise routine, regularly consuming fruits, and reading nutritional labels, positively contribute to nutritious rice consumption. Notably, a lower perception of barriers related to availability and affordability enhances the likelihood of consumption.

However, factors such as age, gender, household size, nutritional knowledge, and vegetable consumption were not significantly associated with nutritious rice consumption. Contrary to our findings, some studies [36, 37] have suggested that nutritional knowledge is linked to healthy eating. This discrepancy may be due to the relatively limited nutritional knowledge in our sample, which was not significantly different between the nutritious rice consumer group and the regular rice

Table 7. Comparison of perceived barriers and benefits to nutritious rice consumption between nutritious and regular rice consumers in Naypyitaw, Myanmar 2023.

Perception Statement	Respondent Group			T Value	Sig.
	Nutritious Rice (n = 80)	Regular Rice (n = 401)	Total (n = 481)		
It is not easy to buy nutritious rice.	3.59	2.87	2.99	3.890	0.000
It is too difficult to frequently consume nutritious rice as the price is higher than normal white rice.	3.05	2.49	2.58	3.282	0.001
Consuming nutritious rice would protect me from getting anemia.	4.18	4.20	4.20	−0.232	0.817

Source: Survey data, 2023.

consumer group. Regarding vegetable consumption, the lack of a significant association may be because Myanmar consumers regularly consume vegetables in their cuisine, so the average number of days vegetables were consumed was similar across both groups, with an average of six days per week. Furthermore, despite strongly believing that nutritious rice has health benefit of preventing anemia, the choice of consuming nutritious rice is not different between two groups of consumers. The estimates show that health belief of consuming nutritious rice was not significantly associated with nutritious rice consumption. In contrast, other studies found that perceived benefits significantly influence the choice of nutritious foods [38, 39]. One possible explanation is that, for our respondents, perceived barriers (e.g., affordability and availability) may be more important than perceived benefits. Even though they recognize the benefits, these barriers may outweigh the influence of perceived benefits on actual consumption [40] and perceived barriers may be the most powerful dimension in the Health Belief Model [33].

Formal education is significantly correlated with the likelihood of consuming nutritious rice. Our results show that a one-year increase in formal education is associated with a marginal 1.8 percentage point increase in the probability of consuming nutritious rice, after controlling for other variables. Higher-educated individuals tend to pay greater attention to nutrition information [41], place a higher value on health [42], enjoy a better quality of life, report better self-assessed health, and maintain stronger social relationships [43]. Education plays a crucial role in translating knowledge into behavior, which is essential for overcoming barriers and promoting healthier eating habits [44]. This association between education and nutritious food consumption aligns with existing literature, indicating that individuals with higher educational attainment are more likely to adopt healthier diets [45–47].

Income also demonstrates a significant association with nutritious rice consumption. Given that nutritious rice is generally more expensive than polished white rice, income influences dietary choices by increasing the demand for healthier, albeit costlier, options [48]. Supporting this, research by Sirasa, Mitchell [49], Slamet, Nakayasu [44, 50] and Robertson, Young [51] indicates a positive correlation between income and healthy food consumption. Furthermore, nutritious rice is primarily sold in packaged form rather than bulk, with income significantly influencing packaged rice consumption [52]. However, the relationship between knowledge of health-related nutrition and purchasing behavior in Myanmar's urban capital city does not align with findings from other urban Asian cities, such as Bangkok, where education influences the value placed on rice quality attributes [53].

The likelihood of consuming nutritious rice is greater in households with vulnerable members, such as children and the elderly, compared to those without. Our results show that having a child in the household (as opposed to not having one) is associated with a 9 percentage point increase in the probability of consuming nutritious rice, while having an elderly member is associated with a 7.5 percentage point increase. This trend may be attributed to the popularity of fortified rice for children's health and development in Myan-

mar, as well as the higher prevalence of health issues, such as diabetes, among the elderly. Data show that the prevalence of diabetes increased from 14.6% to 31.9% among individuals aged 60 and older between 2004 and 2014 [54]. Households with these vulnerable members often demonstrate greater awareness of health implications and prioritize nutritional needs accordingly. This observation aligns with findings by Wang, Wahl [55], which noted that the presence of children or elders positively influences healthy food consumption in China. Similarly, research by Saito, Matsumoto [56] in Japan indicated that households with young children tend to have increased intake of essential nutrients.

Health-related habitual behaviors—such as engaging in regular exercise, increasing fruit consumption, and reading nutritional labels—emerge as significant factors in nutritious rice consumption. These habits serve as strong predictors of food choices, significantly impacting daily dietary practices with minimal reliance on additional information [31]. Previous research has also emphasized the role of physical activity in fostering healthy eating habits. For instance, Sogari, Velez-Argumedo [57] found that regular physical activity is linked to improved dietary practices among college students in the United States. Further studies [58, 59] have highlighted the importance of established habits in promoting healthier food choices. For example, habitual meal planning [58], regular consumption of fruits and vegetables [59], and consistent cooking routines [59] have been shown to make healthier food choices more automatic, reducing the need for conscious decision-making. These habits can help individuals overcome barriers to healthy eating, such as time constraints and decision fatigue.

The likelihood of consuming nutritious rice is greater among consumers who perceive fewer barriers related to availability and affordability. In Myanmar, nutritious rice is not widely available, and its prices are significantly higher than those of regular rice (**Table 1**). Consequently, it is unsurprising that availability and affordability may serve as barriers for some consumers. A 2020 article in a national newspaper highlighted the challenges associated with the availability of equipment necessary for blending fortified rice kernels, which is both expensive and not readily accessible in Myanmar. This high initial investment discourages many small- and medium-sized millers from participating in rice fortification initiatives. Despite the presence of over 2,000 registered rice mills in the country, only 16 have produced fortified rice. As a result, the price of fortified rice is 10% to 15% higher than that of regular white rice, further contributing to low consumer acceptance. By 2020, only 350,000 people—less than 1% of the total population—reported consuming fortified rice [60]. Previous literature similarly emphasizes that availability and affordability are significant barriers to consuming nutritious foods, such as unpolished rice in Nepal [61] and fruits and vegetables in East and Southeast Asia [62].

As in many Asian countries, rice serves as a staple food in Myanmar. Numerous studies indicate that Asian consumers prioritize taste as one of the most preferred attributes of rice. In particular, aroma and softness are highly valued traits in Southeast Asia and China [52, 63]. While nutritional quality, safety, and organic labeling are also significant factors for rice consumers [16, 64], the choice of rice type is greatly influenced by consumption habits [15]. For healthy rice products—such as low glycemic index rice suitable for diabetic consumers and brown rice, which offers greater nutritional benefits than white rice—sensory attributes such as taste [15, 65], texture [66], and naturalness [65] significantly impact consumer preferences. Although rice remains a staple food, urban consumers in various Asian countries, particularly as their incomes rise, increasingly prioritize quality and nutrition in their food choices [15, 16]. Therefore, enhancing the food environment, particularly through education regarding health benefits, may further encourage the consumption of healthier staple foods.

Nutritious rice consumption among urban consumers can also be considered in relation to environmentally responsible behaviour [67], trust management [68], and sustainable brand management of alimentary goods [69]. As urban consumers become more health-conscious, their purchasing choices are often influenced by a brand's environmental and social responsibility. Companies that integrate sustainability into their branding, including environmentally friendly packaging

or fair trade practices, may appeal to these consumers. Additionally, trust management, ensuring transparency in sourcing and production processes, plays a crucial role in promoting long-term loyalty and influencing consumer behavior toward more nutritious and sustainable food options.

Table 8. Estimates of the binomial logit model for the factors associated with consumption of nutritious rice.

Variables	Coefficient	Standard Error	Sig.	Marginal Effects
AGE	−0.018	0.016	0.248	−0.002
GEN	0.477	0.457	0.296	0.055
EDU	0.154	0.047	0.001***	0.018
HHSIZE	−0.010	0.081	0.899	−0.001
CHILD	0.784	0.299	0.009***	0.090
ELDER	0.651	0.308	0.035**	0.075
INCOME	0.028	0.016	0.085*	0.003
KNWL	0.019	0.109	0.861	0.002
EXER	0.809	0.315	0.010**	0.093
VEG	−0.050	0.132	0.703	−0.006
FRT	0.138	0.083	0.094*	0.016
LABEL	0.671	0.320	0.036**	0.077
AVAIL	0.161	0.096	0.093*	0.018
AFFORD	0.172	0.102	0.091*	0.020
BELIEF	0.051	0.149	0.735	0.006
Constant	−6.447	1.444	0.000	
LR χ^2	78.51			
Prob χ^2	0.000			
Pseudo R^2	0.1814			

Source: Survey data, 2023.
Note: ***, **, * denotes significance at 1%, 5% and 10% respectively.

5. Conclusion and Recommendations

This study explores the factors associated with urban consumers in Naypyitaw in their consumption of nutritious rice, revealing significant insights into consumer behavior. Despite the availability of various nutritious rice options, there is a notable lack of awareness among consumers, which contributes to their limited consumption. Education and income significantly shape consumers' decisions, with those possessing higher education and income being more likely to consume nutritious rice. Furthermore, household dynamics, particularly the presence of vulnerable members, impact consumption choices, indicating that health concerns drive some purchasing decisions. Health-related habits also play a vital role; individuals who prioritize physical activity, consume fruits, and pay attention to nutritional information are more inclined to choose nutritious rice. However, consumers face barriers that hinder adoption, particularly concerning the availability and affordability of these rice types in the market.

To increase the consumption of nutritious rice, awareness campaigns about micronutrient deficiencies and their health and economic impacts of nutritious rice are needed for promoting healthy rice consumption in urban Myanmar. Our findings suggest that these campaigns should prioritize households with health vulnerable members and individuals with higher formal education for effective resource allocation.

The low production of nutritious rice, driven by high investment costs and low economies of scale, leads to elevated prices and, consequently, low consumer acceptance. This creates constraints for availability and affordability of nutritious rice. On the contrary, low consumer acceptance of nutritious rice does not generate critical mass to exploit economies of scale, which presently hampers consumption. Therefore, supporting local rice mills in adopting nutritious rice production technologies, potentially through financial incentives, loans, or grants, could help reduce the cost of nutritious rice and improve its availability. Our study also suggests that labelling of nutrition and health benefits on rice packages and promotion campaign including adver-

tisement of health benefits associated with each type of nutritious rice to raise awareness may increase the consumption of nutritious rice in urban Myanmar.

Due to current political situation, this study was conducted only in Naypyitaw Council Territory, the administrative capital of Myanmar. Future study will provide better understanding of urban consumers if other urban areas, such as Yangon, the business district of Myanmar, are included to get a more representative sample. Further research focusing on health belief and food, nutrition and health literacy will provide a more comprehensive understanding of rice consumption behaviors of Myanmar consumers.

Author Contributions

Conceptualization, O.N. and C.M.L.; review of literature, C.M.L., O.N.; methodology, O.N., S.P. and C.M.L. data collection and data analysis, C.M.L.; writing—original draft preparation, C.M.L. and O.N.; writing—review and editing, O.N.; supervision, S.P. and O.N. All authors read and approved the final manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of Kasetsart University (COA No. COA66/042, date of approval 28 August 2023).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the findings of this study are available upon request from the corresponding author.

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Conflicts of Interest

The authors disclosed no conflict of interest.

References

[1] World Health Organization (WHO), 2021. UN report: Pandemic year marked by spike in world hunger. Available from: https://www.who.int/news (cited 21 July 2021).

[2] Food and Agriculture Organization (FAO), 2024. The state of food security and nutrition in the world 2024 – Financing to end hunger, food insecurity and malnutrition in all its forms. FAO: Rome.

[3] Aung, W.P., Htet, A.S., Bjertness, E., et al., 2018. Urban–rural differences in the prevalence of diabetes mellitus among 25–74 year-old adults of the Yangon Region, Myanmar: Two cross-sectional studies. BMJ Open. 8(3), e020406. DOI: https://doi.org/10.1136/bmjopen-2017-020406

[4] Thapa, R., Dahl, C., Aung, W.P., et al., 2021. Urban–rural differences in overweight and obesity among 25–64 years old Myanmar residents: A cross-sectional, nationwide survey. BMJ Open. 11(3), e042561.

[5] Latt, T., Zaw, K., Ko, K., 2019. Measurement of diabetes, prediabetes and their associated risk factors in Myanmar 2014. Diabetes Metab Syndr Obes. 2019(12), 291–298. DOI: https://doi.org/10.2147/dmso.s156270

[6] International Food Policy Research Institute (IFPRI), 2021. Monitoring the Agri-food System in Myanmar: Food vendors—May 2021 survey round. Strategy Support Program Reserarch Note 54. DOI: https://doi.org/10.2499/p15738coll2.134436

[7] International Food Policy Research Institute (IFPRI), 2022. Monitoring the agri-food system in Myanmar: Food vendors—March 2022. Strategy Support Program Reserarch Note 78. DOI: https://doi.org/10.2499/p15738coll2.135903

[8] Minten, B., Goeb, J., Zin, W.K., et al., 2023. Agricultural value chains in a fragile state: The case of rice in Myanmar. World Development. 167, 106244. DOI: https://doi.org/10.1016/j.worlddev.2023.106244

[9] Myint, T., The, N.E.M., Kyaw, E.M.T., et al., 2016. Study on per capita rice consumption and ratio of household expenditure in Myanmar (final report) [Unpublished manuscript]. Yezin Agricultural University: Myanmar.

[10] van Asselt, J., Lambrecht, I., Aung, Z.W., 2024. Vulnerability and welfare during multiple crises. In: Boughton, D., Belton, B., Lambrecht, I., et al., (eds.). Myanmar's agrifood system: Historical development, recent shocks, future opportunities. International Food Policy Research Institute: Washington. DC, USA. Available from: https://hdl.handle.net/10568/155152

[11] Doesthale, Y.G., Devara, S., Rao, S., et al., 1979. Effect of milling on mineral and trace element composition of raw and parboiled rice. Journal of the Science of Food and Agriculture. 30(1), 40–46. DOI: https://doi.org/10.1002/jsfa.2740300108

[12] Ministry of Health and Sports (MoHS), 2019. Technical guidance on rice fortification. Ministry of Health and Sports: Naypyitaw, Myanmar.

[13] Ravichanthiran, K., Ma, Z.F., Zhang, H., et al., 2018. Phytochemical profile of brown rice and its nutrigenomic implications. Antioxidants. 7(6), 71. DOI: https://doi.org/10.3390/antiox7060071

[14] Zhang, G., Malik, V.S., Pan, A., et al., 2010. Substituting brown rice for white rice to lower diabetes risk: A focus-group study in Chinese adults. Journal of the American Dietetic Association. 110(8), 1216–1221. DOI: https://doi.org/10.1016/j.jada.2010.05.004

[15] Fang, P., Zhou, Z., Wang, H., et al., 2024. Consumer preference and willingness to pay for rice attributes in China: Results of a choice experiment. Foods. 13(17), 2774. DOI: https://doi.org/10.3390/foods13172774

[16] My, N.H.D., Van Loo, E.J., Rutsaert, P., et al., 2018. Consumer valuation of quality rice attributes in a developing economy: Evidence from a choice experiment in Vietnam. British Food Journal. 120(5), 1059–1072. DOI: https://doi.org/10.1108/BFJ-05-2017-0277

[17] Central Statistical Organization (CSO), 2021. Myanmar Statistical Yearbook 2021. Ministry of planning and finance: Naypyitaw, Myanmar.

[18] Ministry of Health and Sports (MoHS), 2019. Myanmar Micronutrient and Food Consumption Survey MMFCS (2017–2018) Interim Report. MoHS: Naypyitaw, Myanmar.

[19] Mya Fortified Rice. (n.d.). Posts [Facebook page]. Available from: https://www.facebook.com/myafradmin?mibextid=ZbWKwL

[20] Myan San Riceberry. (n.d.). Posts [Facebook page]. Available from: https://www.facebook.com/myansanRiceberry?mibextid=ZbWKwL

[21] The Little Rice Company Myanmar. (n.d.). Posts [Facebook page]. Available from: https://www.facebook.com/thelittlericemyanmar?mibextid=ZbWKwL

[22] Theingi Rice. (n.d.). Posts [Facebook page]. Available from: https://www.facebook.com/theingirice?mibextid=ZbWKwL

[23] Department of Consumer Affairs, 2024. The fair reference rice prices for October 2024 (in Burmese language). Available from: https://doca.gov.mm/my/node/25527 (cited 7 October 2024).

[24] Train, K.E., 2009. Discrete choice methods with simulation, 2nd ed. Cambridge University Press: Cambridge, UK.

[25] Foxall, G.R., 2010. Interpreting Consumer Choice: The Behavioral Perspective Model. Routledge: New York, NY, USA; London, UK.

[26] Becker, M.H., Maiman, L.A., Kirscht, J.P., et al., 1977. The Health Belief Model and Prediction of Dietary Compliance: A Field Experiment. Journal of Health and Social Behavior. 18(4), 348–366. DOI: https://doi.org/10.2307/2955344

[27] Silva, P., Araújo, R., Lopes, F., et al., 2023. Nutrition and food literacy: framing the challenges to health communication. Nutrients. 15(22), 4708.

[28] Department of Population, 2015. The 2014 Myanmar population and housing census: Naypyitaw Union Territory report. Ministry of Immigration and Population: Naypyitaw, Myanmar.

[29] World Food Programme (WFP), 2019. WFP Myanmar-Rice fortification. Available from: https://www.wfp.org/publications/wfp-myanmar-rice-fortification (cited 21 June 2019).

[30] Thi, M.K., 2017. Fortified rice to feed children in 51 nurseries. Myanmar Times. Available from: https://www.mmtimes.com (cited 21 August 2017).

[31] van't Riet, J., Sijtsema, S.J., Dagevos, H., et al., 2011. The importance of habits in eating behaviour. An overview and recommendations for future research. Appetite. 57(3), 585–596.

[32] Verplanken B., Ryan B., 2018. Psychology of habit. Springer: Berlin, Germany.

[33] Sulat, J.S., Prabandari, Y.S., Sanusi, R., et al., 2018. The validity of health belief model variables in predicting behavioral change: A scoping review. Health Education. 118(6), 499–512.

[34] Zorbas, C., Palermo, C., Chung, A., et al., 2018. Factors perceived to influence healthy eating: A systematic review and meta-ethnographic synthesis of the literature. Nutrition Reviews. 76(12),

861–874. DOI: https://doi.org/10.1093/nutrit/nuy043

[35] Gujarati, D.N., 2009. Basic econometrics, 5th ed. McGraw-Hill: New York, NY, USA.

[36] Wardle, J., Parmenter, K., Waller, J., 2000. Nutrition knowledge and food intake. Appetite. 34(3), 269–275.

[37] Jayne, J.M., Frongillo, E.A., Torres-McGehee, T.M., et al., 2018. A healthy eating identity is associated with healthier food choice behaviors among US Army soldiers. Military medicine. 183(11–12), e666–e670.

[38] Febian, F.I., Syed Annuar, S.N., 2020. Intention to consume towards functional foods among senior citizen in Malaysia. Journal of International Business, Economics and Entrepreneurship (JIBE). 5(2), 56–61.

[39] Yazdanpanah, M., Forouzani, M., Hojjati, M., 2015. Willingness of Iranian young adults to eat organic foods: Application of the Health Belief Model. Food Quality and Preference. 41, 75–83.

[40] Rapoff, M.A., 2018. Assessing Barriers to Therapeutic Regimens for Young People with Juvenile Idiopathic Arthritis. The Journal of Rheumatology. 45, 588–589.

[41] Andrews, H., Hill, T.D., Cockerham, W.C., 2017. Educational attainment and dietary lifestyles. Advances in Medical Sociology. 18, 101–120. DOI: https://doi.org/10.1108/S1057-629020170000018005

[42] Koç, H., van Kippersluis, H., 2016. Thought for Food: Understanding Educational Disparities in Diet. CESR-Schaeffer Working Paper (2016-005).

[43] Lasheras, C., Patterson, A.M., Casado, C., et al., 2001. Effects of education on the quality of life, diet, and cardiovascular risk factors in an elderly Spanish community population. Experimental Aging Research. 27(3), 257–270. DOI: https://doi.org/10.1080/036107301300208691

[44] Boddy, L.M., Knowles, Z.R., Davies, I.G., et al., 2012. Using formative research to develop the healthy eating component of the CHANGE! school-based curriculum intervention. BMC Public Health. 12(1), 710. DOI: https://doi.org/10.1186/1471-2458-12-710

[45] Fard, N.A., Morales, G.D.F., Mejova, Y., et al., 2021. On the interplay between educational attainment and nutrition: A spatially-aware perspective. EPJ Data Science. 10(1), 18.

[46] Lê, J., Dallongeville, J., Wagner, A., et al., 2013. Attitudes toward healthy eating: A mediator of the educational level-diet relationship. European Journal of Clinical Nutrition. 67(8), 808–814. DOI: https://doi.org/10.1038/ejcn.2013.110

[47] McIsaac, J.-L.D., Kirk, S.F., Kuhle, S., 2015. The association between health behaviours and academic performance in Canadian elementary school students: A cross-sectional study. International Journal of Environmental Research and Public Health. 12(11), 14857–14871.

[48] Blaylock, J., Smallwood, D., Kassel, K., et al., 1999. Economics, food choices, and nutrition. Food Policy. 24(2–3), 269–286.

[49] Sirasa, F., Mitchell, L.J., Rigby, R., et al., 2019. Family and community factors shaping the eating behaviour of preschool-aged children in low and middle-income countries: A systematic review of interventions. Preventive Medicine. 129, 105827. DOI: https://doi.org/10.1016/j.ypmed.2019.105827

[50] Slamet, A.S., Nakayasu, A., Bai, H., 2016. The determinants of organic vegetable purchasing in Jabodetabek region, Indonesia. Foods. 5(4), 85.

[51] Robertson, B., Young, P., Kristensen, J., et al., 2018. Strategic review of food and nutrition security in Myanmar: "In support of sustainable development goal (SDG) 2-roadmap to 2030". World Food Programme. Available from: https://www.wfp.org/publications

[52] Bairagi, S., Mohanty, S., Custodio, M.C., 2019. Consumers' preferences for rice attributes in Cambodia: A choice modeling approach. Journal of Agribusiness in Developing and Emerging Economies. 9(2), 94–108. DOI: https://doi.org/10.1108/JADEE-09-2017-0092

[53] Lee, J.Y., Pavasopon, N., Napasintuwong, O., et al., 2020. Consumers' valuation of geographical indication-labeled food: The case of Hom Mali rice in Bangkok. Asian Economic Journal. 34(1), 79–96. DOI: https://doi.org/10.1111/asej.12196

[54] Aung, W.P., Bjertness, E., Htet, A.S., et al., 2019. Trends in diabetes prevalence, awareness, treatment and control in Yangon region, Myanmar, between 2004 and 2014, two cross-sectional studies. International Journal of Environmental Research and Public Health. 16(18), 3461.

[55] Wang, Y., Wahl, T.I., Seale, J.L., et al., 2019. The effect of China's family structure on household nutrition. Food and Nutrition Sciences. 10(2), 198–206.

[56] Saito, A., Matsumoto, M., Hyakutake, A., et al., 2018. The presence of children in households was associated with dietary intake among Japanese married women: The POTATO study. Journal of Nutritional Science. 7, e16. DOI: https://doi.org/10.1017/jns.2018.9

[57] Sogari, G., Velez-Argumedo, C., Gómez, M.I., et al., 2018. College students and eating habits: A study using an ecological model for healthy behavior. Nutrients. 10(12), 1823. DOI: https://doi.org/10.3390/nu10121823

[58] Crawford, D., Ball, K., Mishra, G., et al., 2007. Which food-related behaviours are associated with healthier intakes of fruits and vegetables among women? Public Health Nutrition. 10(3), 256–265. DOI: https://doi.org/10.1017/S1368980007246798

[59] Laska, M.N., Hearst, M.O., Lust, K., et al., 2015. How we eat what we eat: Identifying meal routines and practices most strongly associated with healthy and unhealthy dietary factors among young adults. Public Health Nutrition. 18(12), 2135–2145. DOI: https://doi.org/10.1017/S1368980014002717

[60] Soe, A.P.K., 2020. Government to expand nationwide fortified rice programme. Myanmar Times. Available from: https://www.mmtimes.com (cited 22 January 2020).

[61] Gyawali, P., Tamrakar, D., Shrestha, A., et al., 2022. Consumer acceptance and preference for brown rice—A mixed-method qualitative study from Nepal. Food Science and Nutrition. 10(6), 1864–1874. DOI: https://doi.org/10.1002/fsn3.2803

[62] Cheung, J.T.H., Lok, J., Gietel-Basten, S., et al., 2021. The food environments of fruit and vegetable consumption in east and Southeast Asia: A systematic review. Nutrients. 13(1), 148. DOI: https://doi.org/10.3390/nu13010148

[63] Custodio, M.C., Demont, M., Laborte, A., et al., 2016. Improving food security in Asia through consumer-focused rice breeding. Global Food Security. 9, 19–28. DOI: https://doi.org/10.1016/j.gfs.2016.05.005

[64] Ahmad Hanis, I.A.H., Jinap, S., Mad Nasir, S., et al., 2012. Consumers' demand and willingness to pay for rice attributes in Malaysia. International Food Research Journal. 19(1), 363–369.

[65] Cabral, D., Moura, A.P., Fonseca, S.C., et al., 2024. Exploring rice consumption habits and determinants of choice, Aiming for the development and promotion of rice products with a low Glycaemic Index. Foods. 13(2), 301. DOI: https://doi.org/10.3390/foods13020301

[66] Gondal, T.A., Keast, R.S.J., Shellie, R.A., et al., 2021. Consumer acceptance of brown and white rice varieties. Foods. 10(8), 1950. DOI: https://doi.org/10.3390/foods10081950

[67] Lăzăroiu, G., Ionescu, L., Uță, C., et al., 2020. Environmentally responsible behavior and sustainability policy adoption in green public procurement. Sustainability. 12(5), 2110.

[68] Lazaroiu, G., Andronie, M., Uță, C., et al., 2019. Trust management in organic agriculture: sustainable consumption behavior, environmentally conscious purchase intention, and healthy food choices. Frontiers in Public Health. 7, 340.

[69] Majerova, J., Sroka, W., Krizanova, A., et al., 2020. Sustainable brand management of alimentary goods. Sustainability. 12(2), 556.