RESEARCH ARTICLE

Determinants of Food Insecurity among Municipal Fishing Households during the COVID-19 Pandemic under Alert Level 1 in Kawit, Cavite, Philippines

Kim Irvin T. Protacio[1]*, Maria Theresa M. Talavera[2], Angelina R. Bustos[2], Sherry B. Marasigan[3]

[1] *Department of Science and Technology – Food and Nutrition Research Institute, Bicutan, Taguig City 1631 Philippines*
[2] *Institute of Human Nutrition and Food - College of Human Ecology, University of the Philippines Los Baños, Los Baños Laguna 4030 Philippines*
[3] *Agricultural Systems Institute - College of Agriculture and Food Science, University of the Philippines Los Baños, Los Baños Laguna 4030 Philippines*

ABSTRACT

The COVID-19 pandemic significantly impacted municipal fishing households, a vulnerable group heavily dependent on the sea for their livelihoods. This study aimed to identify the factors contributing to food insecurity among municipal fishing households in Kawit, Cavite. To achieve this, a cross-sectional design and an online survey were utilized. Food insecurity status was assessed using the Household Food Insecurity Access Scale (HFIAS) concurrently with the Household Dietary Diversity Score (HDDS) questionnaire to gain a deeper understanding of the food security status of these fishing households. Multiple logistic regression was employed to analyze the factors contributing to food insecurity. The findings revealed that while dietary diversity was moderate, with households consuming not more than six types of food groups, consuming nutrient-dense foods was limited among fishing households. Alarmingly, a substantial proportion, three out of five households, faced significant food insecurity during the pandemic. Factors contributing to this insecurity included having young adult household heads, low income, and engaging in fewer weekly fishing trips. Conversely, adopting direct catch consumption practices, receiving financial assistance, and receiving both financial and food assistance all reduced the likelihood of food insecurity. These results underscore the urgent need for targeted interventions to address food insecurity among municipal fishing households. Strategies should prioritize promoting nutrient-dense food consumption, enhancing income stability for young adult household heads, improving fishing opportunities, strengthening direct catch consumption, and providing essential food and financial assistance. These measures can not only alleviate food insecurity but also enhance overall well-being during and beyond the ongoing pandemic.

*Corresponding Author: *kitprotacio@gmail.com*
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1. INTRODUCTION

Food insecurity is a multifaceted and pervasive global issue that transcends geographical boundaries, affecting the lives of millions of people and exacerbating inequalities worldwide (FAO 2019). The emergence of the COVID-19 pandemic in late 2019 introduced unprecedented challenges to societies worldwide, further intensifying the vulnerability of marginalized populations, including those engaged in municipal marine fishing (World Health Organization 2020).

The Philippines, an archipelagic nation reliant on its fisheries sector, has been significantly impacted by the COVID-19 pandemic, which has exacerbated food insecurity among coastal communities. The municipal fishing sector, vital to the nation's economy and culture, provides income and food for many households (Béné et al. 2015). However, the pandemic's lockdowns, mobility restrictions, supply

chain disruptions, and economic downturns have heightened vulnerabilities, increasing food insecurity. According to the FAO (1996), food insecurity is a situation in which people do not have regular access to enough safe and nutritious food to lead an active and healthy life. The pandemic has highlighted how direct and indirect factors contribute to food insecurity among vulnerable groups.

This study aims to analyze the factors contributing to food insecurity among municipal marine fishing households during the COVID-19 pandemic in the Philippines. Kawit, Cavite, was chosen as the study area due to its historical reliance on municipal fishing, ease of access for researchers, and the strong support from the local government unit, which facilitated coordination for the study. The research will provide insights into the unique challenges these households face in achieving food security and resilience during crises. Building on existing literature, this study investigates critical factors contributing to food insecurity, including socio-economic determinants such as income, young age, and COVID-19-related factors like the number of positive cases with symptoms (Brown et al. 2022), livelihood assets (Yazdanpanah et al. 2021), coping strategies, and government assistance during the pandemic (Sohel et al. 2022). Despite extensive research on these factors, a significant gap exists in understanding how they specifically impact municipal fishing households.

This study, in turn, seeks to enhance the understanding of the relationship between pandemics, food security, and vulnerable populations, offering insights that can guide policy and intervention strategies to mitigate the impacts of future crises. The findings have the potential to inform evidence-based policies and interventions that can strengthen the resilience of municipal marine fishing households, ensuring their food security and the sustainability of the fisheries sector. This study represents a critical step toward addressing the multifaceted challenges posed by food insecurity and the COVID-19 pandemic in the context of municipal marine fishing in the Philippines.

2. MATERIALS AND METHODS

2.1 Study area and population

The study was conducted in the ten coastal barangays of Kawit, a first-class urban municipality in the northern part of Cavite province within the CALABARZON region of the Philippines, as shown in Figure 1. The study used data from the municipal agricultural and fisheries office of Kawit, collected in

Figure 1. Map of Kawit, Cavite, showing the study area in reference to the Philippine map.

November 2020, which reported a population of 1,515 fisherfolks and 257 fishing-dependent households. The sample size was determined using OpenEpi's sample size calculation for a proportion with a finite population at a 95% confidence level, resulting in an initial sample size of 155 households. To account for a 10% non-response rate, the final sample size was adjusted to 170 households. Inclusion criteria were households actively engaged in municipal fishing as their primary occupation and registered with the municipal agricultural and fisheries office. In contrast, households involved in other forms of fishing, such as aquaculture or commercial fishing, were excluded to maintain a homogeneous study population focused on municipal fishing, thereby mitigating potential variations in food security determinants arising from different fishing practices. Ethical considerations were carefully integrated throughout the research process, including securing informed consent, safeguarding informant confidentiality, and ensuring the study upheld principles of respect, beneficence, and justice.

2.2 Data collection

Data collection was conducted from March to April 2022 during the COVID-19 pandemic under the Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF) Alert Level 1 in Cavite following public health measures. A structured online household survey encoded in Google Forms was used to characterize municipal fishing households, covering socio-economic and demographic profiles, fishing operation characteristics, COVID-19 incidence and related attributes, adapted food coping strategies, and pandemic-related assistance received. To comprehensively evaluate food security status, the Household Food Insecurity Access Scale (HFIAS) was used alongside the Household Dietary Diversity Score (HDDS) questionnaire, providing a nuanced understanding of food insecurity in these households. Telephone interviews were conducted due to limited access to computers and electronic devices among the households. Barangay Nutrition Scholars (BNS) and Barangay Health Workers (BHW) were thoroughly briefed on the study protocol and survey instrument, conducted house-to-house visits to ensure households had stable connections, and offered assistance with any questions. The primary researcher administered the questionnaire during the telephone interviews, ensuring data quality and consistency.

2.3 Data processing and analysis

Data was analyzed using STATA version 16 (Corp LLC, Texas, USA). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were computed to provide an overview of the characteristics of municipal fishing households. This study assessed food insecurity using the Household Food Insecurity Access Scale (HFIAS), developed by Coates et al. in 2007, and its associated methodology. The HFIAS consists of nine questions regarding the household's food situation in the past month, followed by frequency inquiries. Based on the frequency and severity of food access challenges, it classifies households into four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure.

Additionally, to gauge dietary diversity, the study employed the Household Dietary Diversity Score (HDDS), determined by counting the number of distinct food categories consumed by each household in the past 24 hours based on a food recall. Each food category consumed received a score of 1, with the household's overall score ranging from 0 to 12, reflecting the total number of food categories consumed by any household member. These scores were then categorized into terciles, establishing three levels of dietary diversity: low (1–4 food groups), medium (5–8 food groups), and high (9–12 food groups).

Comprehensive analyses were conducted to determine the relationship between household food security status and various independent variables, such as socio-economic and demographic factors, fishing operation characteristics, COVID-19 incidence and related characteristics, food coping strategies, and pandemic-related assistance received. Initial bivariate logistic regression assessed the association between each independent variable and household food security, with food security represented as 0 and food insecurity as 1. Multivariate logistic regression was then employed to identify potential factors contributing to household food insecurity status. Independent variables with significant associations were included in the initial model, while those exhibiting multicollinearity were excluded. Additionally, significant interacting predictors were retained in the final model. The results were reported as odds ratios (ORs) with their corresponding 95% confidence intervals.

3. RESULTS

3.1 Socio-economic and demographic characteristics

The majority of household heads fall within the 20–39 years age group, comprising 55.3%, while those aged 40 and above make up 44.7% (Table 1). The average age of household heads is 43 ± 11 years. Gender-wise, 90% of household heads are male, with female heads representing the remaining 10%. In terms of marital status, 65.3% of household heads are in common-law relationships or widowed, while the remaining 34.7% are married. Educational attainment varies, with 55.8% having at least an elementary level education, 5.8% having no grade completed, 14.1% having at least a high school level education, and 24.1% having other forms of education. Regarding household characteristics, 55.8% of households have more than 5 members, with an average size of 6 members. Regarding income, 60.6% of households earn less than or equal to PHP 15,000 monthly, while 39.4% earn more than PHP 15,000. The mean household income is PHP 14,921 per month.

3.2 Fishing operation characteristics

The surveyed municipal fishing households primarily as shown in Table 2 own their boats (68.82%), with some choosing to rent (16.4%) or share/borrow boats (14.7%). They employ various fishing gears, such as gillnets (55.2%), hooks and lines (38.8%), and traps (5.8%). Fishing trips per week vary, with 38.8% conducting 1 to 2 trips, 32.9% undertaking 3 to 4 trips, and 28.2% participating in 5 or more trips. Trip duration varies as well, with 58.2% spending 3 to 4 hours, 38.2% allocating 5 or more hours, and approximately 3.5% opting for shorter trips of 1 to 2 hours. Household members actively assist in fishing for most (85.8%), with 1 to 2 members

Table 1. Socio-economic and demographic characteristics of municipal fishing households during the COVID-19 pandemic.

Socio-economic and demographic characteristics	n	%
Household head level		
Age		
20-39 years old (young adult)	94	55.29
40 and above years old (middle-aged and old adults)	76	44.71
Mean age (years)	43 ± 11	
Gender		
Male	153	90.00
Female	17	10.00
Marital Status		
Married	59	34.71
Common-law/widowed	111	65.29
Educational attainment		
No grade completed	10	5.88
At least elementary level	95	55.88
At least high school level	24	14.12
Others (technical, vocational, etc.)	41	24.12
Household-level		
Household size		
≤ 5 members	75	44.12
> 5 members	95	55.88
Mean household size	6 ± 1	
Household income (pesos)		
≤ 15,000	103	60.59
≥ 15,000	67	39.41
Mean household income	14,921 ± 3,128	

Table 2. Fishing operation characteristics and COVID-19 incidence in municipal fishing households.

Fishing operations characteristics	n	%
Boat ownership		
Owned	117	68.82
Rented	28	16.47
Shared/borrowed	25	14.71
Fishing gears used		
Gillnets	94	55.29
Hooks and lines	66	38.82
Traps	10	5.88
Fishing trips per week		
1 to 2 trips	66	38.82
3 to 4 trips	56	32.94
5 or more trips	48	28.24
Hours spent per fishing trip		
1 to 2 hours	6	3.53
3 to 4 hours	99	58.24
5 or more trips	65	38.24
Household members helping in main fishing operations		
None	6	3.53
1 to 2 members	146	85.88
3 or more members	18	10.59
Household members helping in gleaning activities		
None	35	20.59
1 to 2 members	121	71.18
3 or more members	14	8.24
Household members helping in offshore activities		
None	56	32.94
1 to 2 members	108	63.53
3 or more members	6	3.53
COVID-19 incidence and other related characteristics		
COVID-19 Positive		
None	164	96.47
≥ 1 member	6	3.53
Quarantined/Isolated		
None	154	90.59
≥ 1 member	16	9.41
Vaccinated		
None	6	3.53
≥ 1 member	164	96.47

involved, while 10.5% involve 3 or more household members. Gleaning activities are significant, engaging 71.1% with 1 to 2 members and 8.2% with 3 or more members. In offshore activities, 63.5% include 1 to 2 household members, 32.9% have none participating, and a smaller percentage (3.5%) engage 3 or more household members.

3.3 COVID-19 incidence and other related characteristics

Table 2 shows that a substantial majority of households (96.4%) report no COVID-19-positive cases among their members, underscoring a relatively low incidence within the surveyed population. However, 3.5% of households have reported at least one member testing positive for COVID-19, signifying that a small proportion of the community has been affected. Notably, 90.5% of households have undergone quarantine or isolation measures, indicating a proactive response to mitigate the spread of the virus. A smaller but still significant proportion (9.4%) has implemented quarantine or isolation measures. Regarding vaccination status, a considerable 96.47% of households report being vaccinated. This suggests a high level of vaccine uptake within the fishing community, reflecting a positive response to preventive health measures.

3.4 Adapted food coping strategies

Examining adapted food coping strategies among municipal fishing households in Kawit, Cavite, during the COVID-19 pandemic (Table 3) reveals the community's resourcefulness and resilience in ensuring food security amid challenging circumstances. Less than 37.65% of households resort to borrowing food, with rice being the most commonly borrowed staple. Moreover, 27.0% of households reported purchasing food on credit, underscoring financial adaptability to sustain essential food supplies, albeit with a deferred payment mechanism. Direct catch consumption emerged as a notable strategy, with 22.3% of households relying on their own fishing activities to meet their nutritional requirements. This perceived self-sufficiency reflects the utilization of local resources and traditional fishing practices as a direct means of securing food during the pandemic. In response to economic challenges, 12.9% of households engaged in various income-generating activities, including laundry for neighbors in exchange for a small amount of cash and participating in fish processing activities such as sun drying. These not only secure basic needs but also address broader financial stability concerns, highlighting the community's resilience in meeting essential requirements amid economic challenges.

3.5 Pandemic-related assistance received

Approximately 50% of households reported receiving both food and financial assistance, as shown in Table 3. The food aid typically comprises packs containing rice, canned goods, and noodles, while the financial assistance, known as "ayudas," provided by the government, consists of a substantial amount of cash intended for purchasing food and addressing various needs within fishing households. Furthermore, 27.6% of households received exclusively food assistance, emphasizing the importance of securing nutritional support during times of economic strain. The observation that 8.2% of the community exclusively received financial assistance underscores the diverse needs within fishing households, emphasizing that certain families solely have access to or are provided with monetary support to navigate economic uncertainties. About 16.4% of households reported not receiving any assistance. While this may indicate a level of self-sufficiency or reliance on alternative coping mechanisms, it also raises questions about the accessibility and distribution of pandemic-related aid in the community.

Table 3. Adapted food coping strategies and assistance received by municipal fishing households during the COVID-19 pandemic.

Food Coping Strategies	**n**	**%**
Borrowed food	64	37.65
Purchased food on credit	46	27.06
Direct catch consumption	38	22.35
Engaged in other income-generating activities	22	12.94
Pandemic-related assistance		
Received food and financial assistance	81	47.65
Received food assistance	47	27.65
Received financial assistance	14	8.24
Did not receive any assistance	28	16.47

3.6 Food (in)security of municipal fishing households during the pandemic

A majority of households (58.2%) reported being food insecure, underscoring the prevalence of difficulties in accessing a stable and nutritious food supply during this challenging period. Within the food insecure category, 15.8% are mildly food insecure, 28.8% are moderately food insecure, and 13.53% are severely food insecure, indicating varying degrees of vulnerability within this subset of households. Conversely, 41.7% of households reported being food secure, suggesting that a substantial portion of the community has successfully maintained consistent access to an adequate and diverse food supply despite the pandemic-related disruptions.

Furthermore, nearly half of the households (45.6%) expressed concern about not having enough food, indicating a substantial level of worry within the fishing households (Table 5). Additionally, a significant proportion (47.3%) reports that household members are unable to eat the kinds of food they prefer due to resource constraints, underlining a limitation in food choice and access. Moreover, more than half of the households (50.8%) report that a household member has to eat a limited variety of food due to a lack of resources, indicating a constraint in dietary diversity. Compromises in food preferences are emphasized as a substantial number of households (57.5%) reveal that at least one member had to eat food they did not want due to resource constraints. A majority of households (59.2%) report instances where a household member had to consume a smaller meal than desired, reflecting challenges in meeting basic nutritional needs. The severity of food scarcity is highlighted by a significant percentage (72.2%) indicating that at least one household member had to eat fewer meals in a day due to insufficient food.

Extreme situations are prevalent, with a high proportion of households (89.7%) reporting situations where there was no food of any kind due to resource constraints, indicating extreme food shortages. The persistence of hunger within fishing households is evident, as a substantial number of households

Table 4. Food security status and household dietary diversity score of municipal fishing households during the COVID-19 pandemic.

Household Dietary Diversity Score	**n**	**%**	**Mean**	**(95% CI)**
Total HDDS	170	100	5.72	4.16 - 7.28
Consuming 1-4 food groups (low)	49	28.82	3.9	3.60 - 4.20
Consuming 5-8 food groups (medium)	113	66.47	6.26	5.25 - 7.27
Consuming 9-12 food groups (high)	8	4.71	9.26	8.83 - 9.69
Households consuming the 12 food groups	**n**	**%**		
Cereals	166	97.65		
Spices, condiments, and beverages	165	97.06		
Oils and fats	165	97.06		
Sugar	115	67.65		
Fish and seafood	99	58.24		
Vegetables	85	50.00		
Meat and poultry	40	23.53		
Egg	36	21.18		
Roots and tubers	29	17.06		
Milk and milk products	29	17.06		
Legumes, nuts, seeds	22	12.94		
Fruits	21	12.35		
Household Food Security Status				
Food secure	71	41.76		
Food insecure	99	58.24		
Mildly food insecure	27	15.88		
Moderately food insecure	49	28.82		
Severely food secure	23	13.53		

Table 5. Percentage distribution of frequency of food insecurity experiences among municipal fishing households during the COVID-19 pandemic.

Occurrence Question	Frequency of Experience			
	No	Yes, rarely	Yes, sometimes	Yes, often
1. You worry that your household will not have enough food.	3.1	24.7	23.5	6.2
2. Any household member is not able to eat the kinds of food you prefer because of a lack of resources.	47.3	26.4	23.3	3.1
3. Household member has to eat a limited variety of food due to a lack of resources.	50.8	26.6	20.0	2.6
4. Any household member had to eat some food that they really did not want to eat because of a lack of resources to obtain other types of food.	57.5	18.2	14.9	2.4
5. Any household member had to eat a smaller meal than you felt you needed	59.2	21.8	17.7	1.3
6. Any other household member had to eat fewer meals in a day because there was not enough food.	72.2	15.4	8.8	3.6
7. No food of any kind in your household because of a lack of resources to get food.	89.7	6.9	3.2	0.2
8. Any household member goes to sleep at night hungry because there is not enough food.	80.4	11.6	4.9	3.1
9. Any household member goes a whole day and night without eating anything because there is not enough food.	88.6	8.6	2.1	0.7

(80.4%) report that a household member goes to sleep hungry due to insufficient food. A notable percentage (88.6%) of at least one household member goes a whole day and night without eating anything due to insufficient food, indicating prolonged periods of food deprivation.

3.7 Dietary diversity score of municipal fishing households

Analyzing households based on the number of food groups consumed reveals distinct dietary diversity patterns. Approximately 28.82% fall within the low dietary diversity range (1–4 food groups), encompassing cereals, spices, condiments, beverages, sugar, and oils/fats, signaling challenges in accessing a varied range of foods and potentially impacting nutritional quality. In contrast, a significant majority (66.47%) falls within the medium dietary diversity range (5–8 food groups), exhibiting a relatively better level of dietary diversity with an average score of 6.26 (95% CI: 5.25–7.27). These households incorporate fish, seafood, vegetables, meat, poultry, and eggs, indicating a broader range of food choices and potentially more balanced nutrition. A smaller proportion (4.71%) falls within the high dietary diversity range (9–12 food groups), showcasing a high level of dietary diversity with an average score of 9.26 (95% CI: 8.83–9.69). These households consume the initial eight groups plus roots and tubers, milk/milk products, legumes, nuts, seeds, and fruits, suggesting a richer and more varied diet. It is essential to recognize that these patterns may be influenced by challenges related to access or the preferences of fishing households, contributing to observed variations in dietary diversity.

Amid the pandemic, high rates of staple consumption, such as cereals, spices, condiments, oils, and fats (97.65%, 97.06%, and 97.06%, respectively), underscore households' reliance on essential energy sources. While marine resources significantly contribute to protein intake (58.24% consume fish and seafood), there is potential to enhance protein source diversity. Low consumption of fruits (12.35%) and vegetables (50.00%) signals the need for interventions to encourage higher intake of fresh produce, crucial for a well-balanced diet. Challenges in achieving protein diversity are evident, emphasizing the importance of promoting varied protein intake for overall nutritional health during the pandemic. Additionally, reported sugar consumption (67.65%) highlights the necessity for targeted education and interventions aligned with dietary recommendations to address health concerns associated with excessive sugar intake during these challenging times.

3.8 Multivariate logistic regression on determinants of food insecurity

Younger household heads (aged 20–39) are significantly more likely to experience food insecurity (AOR of 6.69, 95% CI: 2.21–20.26, p=0.001) compared to those aged 40 and older, highlighting the role of age as a critical factor influencing vulnerability to food

Table 6. Factors associated with food insecurity of municipal fishing households during the pandemic.

Factors	Adjusted Crude OR (95% CI)	*p*-value
Household head age		
20-39 years old (young adult)	6.69 (2.21-20.26)	0.001
40 and above years old (middle-aged and old adults)	1.00	
Household income		
≤ 15,000 pesos	63.31 (12.43-322.53)	<0.000
≥ 15,000 pesos	1.00	
Number of fishing trips per week		
1 to 2 trips	7.51 (1.95-28.89)	0.003
3 to 4 trips	1.73 (0.51-5.87)	0.382
5 or more trips	1.00	
Food coping strategies		
Borrowed food	1.00	
Purchased food on credit	0.66 (0.17-2.61)	0.554
Direct catch consumption	0.12 (0.03-0.53)	0.005
Engaged in other income-generating activities	1.67 (0.29-9.48)	0.565
Pandemic-related assistance		
Received food assistance	1.00	
Received financial assistance	0.20 (0.06-0.70)	0.012
Received both	0.12 (0.02-0.76)	0.024
Did not receive any	0.75 (0.19-2.96)	0.686

Note: Statistical significance was determined at a *p*-value of < 0.05.

insecurity. Households with a monthly income of ≤ 15,000 pesos have substantially higher odds of food insecurity (AOR of 63.31, 95% CI: 12.43–322.53, p<0.000) compared to those with higher incomes. This underscores the direct connection between income levels and challenges in accessing an adequate food supply.

Moreover, the frequency of fishing trips per week is closely associated with food insecurity, with households conducting 1 to 2 trips facing significantly increased odds (AOR of 7.51, 95% CI: 1.95–28.89, p=0.003). Specific food coping strategies also influence food security, with direct consumption of caught fish significantly reducing the odds of food insecurity (AOR of 0.12, 95% CI: 0.03–0.53, p=0.005). However, purchasing food on credit does not show a significant association with food security. Notably, households receiving financial assistance (AOR of 0.20, 95% CI: 0.06–0.70, p=0.012) and both food and financial assistance (AOR of 0.12, 95% CI: 0.02–0.76, p=0.024) have lower odds of food insecurity, indicating the positive impact of external support.

4. DISCUSSION

4.1 On the municipal fishing household profile

The majority of the municipal fishing household heads being within the 20-39 age group suggest a relatively youthful population in the study area, which can influence household decision making dynamics as well as labor in the fishing operation. This trend aligns with findings from other developing regions, where younger household heads are more common in rural, resource-dependent populations, influencing both economic and social structures (Kwigizile et al. 2017). The gender disparity in household heads, with a predominance of males, is consistent with traditional gender roles in the fishing industry, where men are often the primary providers through fishing activities (Harper et al. 2013; Choo et al. 2018). This trend is mirrored in similar communities, where men predominantly take on the role of household head due to their involvement in fishing, a male-dominated occupation. Additionally, the high proportion of common-law relationships

or widowed household heads can be attributed to the unique challenges faced by fishing families, such as prolonged absences due to long fishing trips and the high-risk nature of the occupation, which often leads to non-nuclear family structures or the loss of partners.

Educational disparities in coastal communities are shaped by factors such as limited access to quality educational resources, vulnerability to natural disasters, and economic reliance on maritime activities, all of which can contribute to unequal educational outcomes. Studies have shown that these communities often face challenges in securing quality education, especially when schools are disrupted by environmental hazards or economic pressures related to fishing livelihoods (Badjeck et al. 2010). Additionally, household characteristics, such as larger family sizes and low income, significantly influence food insecurity. The struggle for food security is often exacerbated by economic constraints, limited access to family planning, and resource shortages (Cinner et al. 2016). Such findings are consistent with global patterns where poverty and limited access to resources are major drivers of food insecurity in fishing communities (Sumaila et al. 2019).

The analysis of fishing operations reveals the importance of self-reliance, with boat ownership being a key indicator of livelihood security. Adaptive strategies, including diverse gear use and varying fishing trip frequencies, help mitigate economic risks and uncertainties, particularly in times of crisis. The involvement of household members in fishing activities and gleaning highlights the communal nature of fishing livelihoods, providing an additional layer of support and resilience within the family unit. These findings align with broader research that emphasizes the role of community cohesion and diversified income-generating strategies in improving resilience during challenging times (Yusriadi and Kaslin 2025).

In the context of COVID-19, the community's proactive response to the pandemic, including vaccination rates and quarantine adherence, reflects its resilience and ability to safeguard public health (Estrada et al. 2022) 2020). However, challenges persist, indicating the need for continued health interventions to address emerging vulnerabilities (Bhattacharya et al. 2020). Food coping strategies, such as borrowing, using credit for food purchases, and direct fish consumption, reveal the community's resourcefulness and ability to adapt during crises (FAO 2020). These strategies reflect broader findings that highlight the role of community-based resource management in times of crisis (Béné et al. 2015). The assessment of pandemic-related assistance shows a varied landscape, with dual assistance programs addressing both economic and food security needs. However, the non-receipt of aid for some households raises questions about the accessibility and effectiveness of support mechanisms (Cho et al. 2020).

4.2 On food security status of municipal fishing households during the pandemic

A majority of households reported food insecurity, indicating widespread difficulties in accessing a stable and nutritious food supply during the pandemic. These households experienced varying degrees of food insecurity, with some facing moderate to mild food insecurity, highlighting differing levels of vulnerability.

Conversely, less than half of the households reported being food secure, suggesting that a substantial portion of the community successfully maintained consistent access to an adequate and diverse food supply despite pandemic-related disruptions. This diversity in food security statuses underscores the need for targeted interventions that address the specific challenges faced by both food-secure and food-insecure households. These findings align with broader literature emphasizing the multifaceted nature of food security challenges in diverse contexts (Smith et al. 2020; FAO 2019).

The comprehensive overview of food insecurity experiences among municipal fishing households during the COVID-19 pandemic provides valuable insights into the community's challenges. The data, collected through a series of occurrence questions, reveals varying degrees of food insecurity experiences within households, ranging from concerns about food availability to severe instances of hunger and compromised nutrition. The high prevalence of concerns, such as worrying about not having enough food, inability to eat preferred foods due to resource constraints, and limited variety of food choices, emphasizes the multidimensional nature of food insecurity.

Instances where households report having no food at all due to resource constraints further highlight the severity of food scarcity. These findings align with existing literature highlighting the multifaceted impacts of the COVID-19 pandemic on food security, with vulnerable populations facing heightened challenges (Pérez-Escamilla et al. 2020; Laborde et al. 2020). Targeted interventions should consider these nuanced experiences to effectively address the diverse dimensions of food insecurity within the community.

4.3 On the dietary diversity score of municipal fishing households during the pandemic

The average HDDS for the sample population is 5.72, indicating moderate dietary diversity within the community. This aligns with studies emphasizing dietary diversity's importance for optimal nutrition and health (Ruel 2003; Kennedy et al. 2010). Over a quarter of households have low dietary diversity (1–4 food groups), potentially impacting diet quality (FAO 2010). More than half fall into the medium dietary diversity range (5–8 food groups), suggesting better diversity. A smaller proportion has high dietary diversity (9–12 food groups), indicating a rich and varied diet. Analyzing food consumption patterns, staples like cereals, spices, condiments, and oils are prevalent, reflecting reliance on essential energy sources (de Bruin and Holleman 2023). While marine resources contribute to protein intake, promoting alternative protein-rich foods is essential (Golden et al. 2016). Low fruit and vegetable consumption highlights the need for interventions to boost their intake.

Challenges in achieving protein diversity are evident, with fewer households consuming meat, poultry, and eggs. Gibson et al. (2010) stress the need to promote varied protein sources. Dairy, legumes, nuts, and seeds are consumed by less than half of households, presenting an opportunity to improve dietary diversity and micronutrient intake (Arimond et al. 2010). Additionally, two-thirds of households need education and interventions to reduce sugar consumption, aligning with the research of Te Morenga et al. (2013) linking excessive sugar intake to health issues like obesity and diabetes.

4.4 On determinants of food insecurity among municipal fishing households

Younger household heads (20–39 years old) are more susceptible to food insecurity, a trend commonly observed in various studies, as younger individuals often face challenges such as lower income and less stable livelihoods, heightening their vulnerability (Lauren et al. 2021). This is further compounded by the significant association between lower household income (≤ PHP 15,000) and food insecurity, consistent with findings from other regions where economic hardship directly impacts food access (Loopstra et al. 2016). In the context of fishing-dependent households, the frequency of fishing trips plays a vital role in food security, with households conducting fewer trips (1 to 2 per week) facing heightened food insecurity. This finding aligns with research highlighting the precarious nature of livelihoods reliant on small-scale fisheries, where limited fishing opportunities contribute to food insecurity (Allison et al. 2011). Interestingly, direct consumption of caught fish proves to be a protective factor against food insecurity, reinforcing the importance of local food resources in mitigating food access challenges (Charlton et al. 2016). Conversely, purchasing food on credit does not appear to significantly reduce food insecurity, echoing studies that suggest credit-based food procurement may not effectively address underlying access and affordability issues in vulnerable populations.

Remarkably, receiving financial assistance only and both food and financial assistance are associated with lower odds of food insecurity. This highlights the positive impact of external support in alleviating food insecurity and aligns with studies emphasizing the role of social protection programs in enhancing food security outcomes (Ruel et al. 2018). These findings underscore the importance of addressing economic factors, promoting alternative income sources, and improving access to support programs to enhance food security among municipal fishing households during the ongoing pandemic.

5. CONCLUSION

The fishing community in Kawit, Cavite, has shown resilience during the COVID-19 pandemic, adapting to changes in demographics, socioeconomic factors, and food security. While proactive health measures like quarantine and vaccination demonstrate this resilience, ongoing health interventions are needed. Food security within the community reveals a complex situation, with varying degrees of food access challenges. Household dietary diversity needs improvement, particularly in protein source variety. Determinants of food insecurity highlight vulnerabilities among younger household heads and the link between income levels and food access challenges, emphasizing the importance of livelihood diversification. Promoting local resources like direct catch consumption reduces food insecurity, while external support, especially financial aid, has a positive impact.

Improving the well-being of the Kawit, Cavite fishing community requires tailored interventions based on age, income, and livelihood strategies. Health interventions should prioritize prevention and healthcare access. Community-level food security programs should stress resilience, diversified

livelihoods, and support for vulnerable households. Promoting diverse food intake through nutritional education and encouraging livelihood diversification beyond fishing will boost economic resilience. Utilizing local resources like direct catch consumption is sustainable. Advocacy for and enhancement of social protection programs, encompassing both food and financial assistance, is essential to reduce economic vulnerabilities and enhance overall community food security.

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AUTHOR CONTRIBUTIONS

Protacio KIT: Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing – Review and Editing, Visualization, and Project Administration. **Talavera MTM:** Conceptualization, Methodology, Writing – Original Draft, Supervision, Writing – Reviewing and Editing, Answering Reviewers Comments and Suggestions. **Bustos AR**: Methodology, Writing – Original Draft, Supervision, Writing – Reviewing and Editing, Answering Reviewer's Comments and Suggestions. **Marasigan SB:** Methodology, Writing – Original Draft, Supervision, Writing – Reviewing and Editing.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest in any way.

ETHICS STATEMENT

The authors obtained informed consent from all participants, ensuring they were fully informed about the study's purpose, procedures, potential risks, and benefits. Participation was voluntary, with the right to withdraw at any time without consequence. Confidentiality of personal information was strictly maintained.

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