ISSN 0868 - 2836

VIETNAM JOURNAL OF PREVENTIVE MEDICINE

Volume 34, Issue 8, 2024

Vietnam Journal of Preventive Medicine — Volume 34, Issue 8, 2024

Vietnam Journal of Preventive Medicine

Address: N°1 - Yersin Street, Hai Ba Trung District, Hanoi, Vietnam
Tel: +84 - 24 - 3 972 3938
Email: tapchiyhdp@vjpm.vn
Website: www.vjpm.vn

2024 Published by the Vietnam Association of Preventive Medicine

VIETNAM JOURNAL OF PREVENTIVE MEDICINE
Volume 34, Issue 8, 2024

CONTENTS

All articles in the following section each have been reviewed by two independent experts

ORIGINAL ARTICLES

DOI: https://doi.org/10.51403/0868-2836/2024/2140

Integrated One Health Perspective on facility responses in Hue city's food supply chains during the COVID-19 crisis

Le Dinh Duong[1*], Dang Thi Anh Thu[1], Tran Binh Thang[1], Nguyen Thanh Gia[1], Nguyen Minh Tu[1], Dang Thi Thanh Nha[1], Nguyen Xuan Hoa[2], Nguyen Thi Quynh Anh[2]

[1] *University of Medicine and Pharmacy, Hue University, Hue City, Vietnam*
[2] *University of Agriculture and Forestry, Hue University, Hue City Vietnam*

Abstract

The COVID-19 pandemic is a global crisis and can has led to disruptions in the food supply chain. This study examines the responses of food supply chain facilities in Hue City during the COVID-19 crisis through an integrated One Health perspective, focusing on the knowledge, attitudes, and practices of workers, as well as the adaptive strategies of workplaces. A cross-sectional survey was performed to investigate the food supply chain participants related to the Hue City, Vietnam markets. Data was collected from a direct interview and rapid assessment among 300 workers and 28 facilities in the chain. The results indicated that the COVID-19 pandemic disrupted the chain, with 12 out of 28 workplaces closed and half of the sites experiencing infection. Almost of workers had understood knowledge and strongly agreed with the COVID-19 preventive strategy. The mean attitude item score ranged from 4.15 to 4.37. Regarding individual responses, all workers (100%) wore masks, and 88.7% indicated that their workplaces had mask-wearing regulations in place. The study found that the COVID-19 pandemic negatively affected the mental health of 56.3% of participants and caused delays in health examinations for 44% of them. This study highlights the urgent need for implementing effective measures to prevent COVID-19 transmission within the food supply chain. An integrated One Health approach is crucial in mitigating the disease's impacts and potential future crises. We can ensure food security through coordinated efforts between public health authorities, agricultural stakeholders, and other relevant sectors.

Keywords: *One health; COVID-19; food supply chain; responses*

1. Introduction

The COVID-19 pandemic is a global crisis and has enormously affected every aspect of human life. The ongoing coronavirus pandemic 2019 (COVID-19) threatens global health, causing unprecedented social, economic, and political disruptions [1]. The food supply chain is one of the most important sectors of the economy, and COVID-19 has impacted all processes from the field to the consumer [2, 3]. During this period, food supply disruptions in developing countries varied and were often severe with limited conditions. Because a food supply chain is domino-like, the whole chain is affected when any part of the process is unsafe during the pandemic.

Disruptions in the food supply can result in shortages, limit access to nutritious food, and compromise the immune system, raising the risk of chronic diseases. This may compel consumers to rely on unprotected or unhealthy food sources, increasing the likelihood of foodborne illnesses and related health issues.

*Corresponding author: Le Dinh Duong
Address: Faculty of Public Health, University of Medicine and Pharmacy, Hue University, Vietnam
Tel: +84 905 335 724
Email: ledinhduong@huemed-univ.edu.vn or ldduong@hueuni.edu.vn
Received 27 September; In revised from 14 October; Accepted 27 December 2024

The current research was conducted during the fourth wave of the COVID-19 pandemic. In the Vietnamese context, the traditional market is vital in the food supply chain, particularly in rural areas. It is not only a place to contribute food but also reflects social values and culture. Markets provided a place to trade their daily necessities while socializing and exchanging local news. Therefore, any disruptions of this chain can significantly impact the whole population. One Health (OH) concept is an approach that recognizes that the health of people is closely connected to the health of animals and our shared environment, particularly during a pandemic [4]. According to WHO, the COVID-19 pandemic powerfully illustrates the deep interconnection between human health, animal health, and ecosystem health [5, 6]. Therefore, how we investigate the relationship between the COVID-19 pandemic and the food supply chain response to find the strategies to protect this chain.

This study examines the responses of food supply chain facilities in Hue City during the COVID-19 crisis through an integrated One Health perspective, focusing on the knowledge, attitudes, and practices of workers, as well as the adaptive strategies of workplaces.

2. Methods

Study population

For the first objective, employees involved in the food supply chain for the Hue city market were invited to participate. For the second objective, COVID-19 risks at workplaces were assessed. During the current study context, we used the conventional sample method to ensure the variety of facilities based on the food supply chain for the market in Hue City.

Place and time

This study was conducted from October 2021 to March 2022, during the fourth wave of COVID-19 in Vietnam.

Figure 1 presents the setting sites in this research.

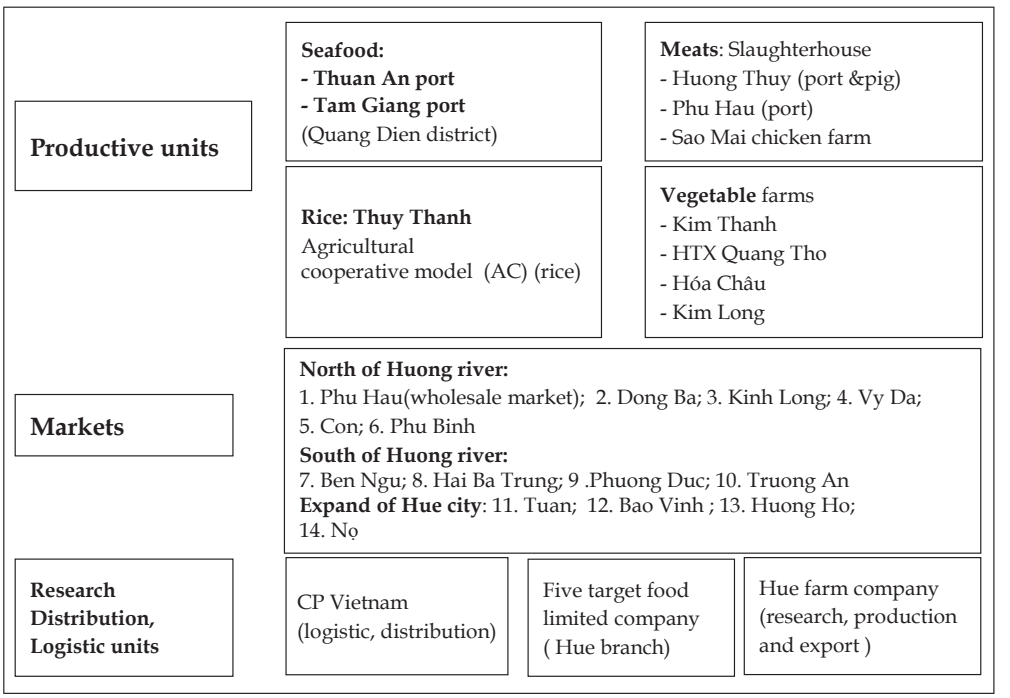

Fig.1. *The setting sites*

Study design

A cross-sectional survey was performed to investigate the participants in the food supply chains related to the markets in Hue City, Vietnam.

Sample size

For the first objective, a total of 300 individuals working in the food supply chain, including farmers, fishers, logistics personnel, small traders, and slaughterhouse workers, were invited to participate. For the second objective, 28 facilities within the food supply chain were included in a Rapid Assessment to evaluate COVID-19 pandemic risks.

Sampling methods

We used conventional methods to select the study sites and participants. The work sites were involved in the food supply chain serving the Hue city food market.

Variables

The research instruments were developed using the One Health approach as a central principle. Based on COVID-19, the government's guidelines were used to perform preventive disease measures.

The questionnaire included demographic characteristics; COVID-19 vaccine situation; occupation characteristics; knowledge; attitude and practice toward COVID-19; and impacts of the COVID-19 pandemic on employees in the food supply chain.

In the second objective, the current research developed a rapid assessment tool to evaluate the risk of COVID-19 in the setting sites where they were provided and involved in the food supply chain. The different facilities were selected, including fish port, slaughterhouse, farmers, research and development, logistics, and markets. This instrument was developed using the concept of COVID-19 preparedness and response [7,8]. According to the Vietnamese Ministry of Health, the 4-color codes were used to guide the COVID-19 risk. Green-, yellow-, orange- and red color illustrated the risk of COVID-19 as lowest; moderate, high, and very high risk, respectively.

Data collection

The data was collected using direct observation and in-depth interviews with the employees at the field sites using a structured questionnaire and a rapid assessment checklist.

Statistical analysis

Descriptive statistics were conducted to describe the KAP and Rapid assessment at the field sites. Mean with standard deviation (SD) was presented for continuous data, and percentage was used for categorical data. All statistical analyses were calculated using Stata 14.0, which had a significant level of less than 0.05.

Ethical issues

The Provincial Health Department approved the research, workplaces and all participants provided their consent. All information was kept anonymous.

3. Results

3.1 Knowledge, attitude and practice toward the COVID-19 pandemic of participants

The current research invited a total of 300 participants who were employed in different settings sides, comprising ports, farms, production units, research, distribution, logistics, and direct selling in markets. Most participants were small traders (64.7%); production sites (31,3%), and research and development units (4%).

We present the general characteristics of workers in Table 1. The mean age was 47 years and ranged from 18 to 82 years. Almost all of the employees were female (77.3%), small traders at the markets (70.7%), a junior high school (34.3%); married status (76%); and lived in Hue city (78.0%).

Table 1. *Baseline characteristics of participants (n=300)*

Variables	Characteristics	Number	Percentage
Age (years)	Mean ± Standard deviation: 47.49 ± 12.72 Range: 18 – 87		
Sexes	Male	68	22.7
	Female	232	77.3
Occupation	Breeder/ farmer	33	11.0
	Fishermen	1	0.3
	Worker	8	2.7
	Slaughters	23	7.7
	Small trader	212	70.7
	Driver	8	2.7
	Others	9	3.0
	Sellers	6	2.0
Educational level	Illiteracy	25	8.3
	Primary school	83	27.7
	Junior high school	103	34.3
	High school	56	18.7
	Intermediate	6	2.0
	College/ university level	27	9.0
Marital status	Single	50	16.7
	Married	228	76.0
	Divorce	7	2.3
	Widow	15	5.0
Health insurance	Yes	281	93,7
Residence	Hue city	234	78.0
	Other districts	66	22.0

Almost all employees had at least two doses of the COVID-19 vaccine, and only 5.3% of workers were infected with the first dose. Generally, their relatives were vaccinated as WHO recommended (over 95%) (Table 2).

Table 2. *COVID-19 vaccine situation of workers and their family members (n=300)*

Subjects	Total	No	First dose	Second dose	Third dose
Workers	300	1 (0.3%)	16 (5.3%)	188 (62.7%)	95 (31.7%)
Family members					
Children (< 12)	108	108 (100%)	-	-	-
Children (12 ≤ 18)	79	4 (5.1%)	8 (10.1%)	64 (81.0%)	3 (3.8%)
Adult (18 ≤ 60)	261	3 (1.1%)	11 (4.1%)	160 (61.3%)	90 (34.5%)
Elderly (60+)	99	6 (6.1%)	8 (8.1%)	62 (62.6%)	32 (32.3%)

The pattern of direct contact among employees was the highest between co-workers (67.3%), then customers (62.7%), and small traders (55.3%).

Table 3. *Personal network in workplaces (n=300)*

Characteristics	Number	Per cent
Co-worker	202	67.3
Food suppliers	84	28.0
Logistics	79	28.5
Small traders	166	55.3
Customers	188	62.7
Material supplier	14	4.7
No direct contact with others	23	7.7

Knowledge of COVID-19 disease among participants

Only 48.3% of participants answered the causes of the disease correctly; a transmitted way of COVID-19 spread through the small liquid (71.0%). Regarding knowledge of COVID-19 symptoms, fever and dry cough were the most commonly recognized signs of the disease.

Table 4. *Knowledge of COVID-19 disease among participants (n=300)*

No.	Content	Correct answer n (%)
1.	Causes of COVID-19	145 (48.3)
2.	Transmitted way of COVID-19	
	Small liquid	213(71.0)
	Close directly contact	146 (48.7)
3.	COVID-19 variants	116 (38.7)
4.	People without symptoms can spread	78 (26.0)
5.	Symptoms of COVID-19 infection	
	Fever	240 (80.0)
	Dry cough	203 (67.7)
	Loss of smell	74 (24.7)
	Nausea or vomiting	14 (4.7)
	Sneezing	57 (19.0)
	Difficulty breathing	130 (43.3)
	Tiredness	124 (41.3)
	No symptom	23 (7.7)
6.	Response: When there are symptoms or signs of suspected COVID-19 infection, how should we handle it?	
	Self-quarantine at home	162 (54.0)
	Avoid contacting others	98 (32.7)
	hand sanitization	102 (34.0)
	Mouth and eye hygiene	50 (16.7)
	Wear mask	156 (52.0)
	Contact to find the medical assistant	163 (54.3)
	Access medical institutes	113 (37.7)
7.	COVID-19 diagnosis methods	
	PCR diagnosis	90 (30.0)
	Antibody rapid test	137 (45.7)
	Symptoms	15 (5.0)
	Unknown	58 (19.3)
8.	The epidemic prevention measures	
	Wear mask	231 (77)
	Clean hands	181 (60.3)
	Keep distancing	152 (50.7)
	Avoiding crowded places	103 (34.3)
	Unknown/ no answer	71 (23.7)
9.	Vaccines types	160 (53.3)
	AstraZeneca	101 (33.7)
	Modena	39 (13.0)
	Phifer-BioNTech	80 (26.7)
	Vero Cell	115 (38.3)
	Other	7 (2.3)
10.	Preventive COVID-19 at workplaces	
	Facemask	279 (93.0)
	Keep distancing	163 (54.3)
	No touching eyes, nose, or mouth	62 (20.7)
	Do not share personal belongings	47 (15.7)
	Washing hand	186 (62.0)
	Report to responsible staff	51 (17.0)

The attitude of workers toward COVID-19 disease

The mean score of attitude in wearing a mask vaccine ranged from 4.15 to 4.37, and it was higher than others. The COVID-19 vaccine received the highest level of agreement, with 98% of participants in favor.

Table 5. *The attitude of workers toward COVID-19 disease (n=300)*

No. items	Contents	Mean ±SD	Agree/strongly agree (%)
A1	The preventive measure of the local government response	4.07 ± 0.44	95.0
A2	The preventive measure of the government response	4.04 ± 0.48	94.0
A3	Wearing a mask	4.31 ± 0.52	97.3
A4	Agreement on vaccination	4.35 ± 0.52	98.0
A5	Agreement on third doses of the vaccine	4.37 ± 0.57	95.3
A6	Agreement on the repeated dose per year	4.15 ± 0.67	87.7
A7	Selected vaccine types	3.87 ± 0.82	71.3
A8	Willing to pay for the vaccine	3.62 ± 0.80	67.3
A9	Willing to pay for testing COVID-19	3.71 ± 0.73	71.7
A10	Willing to pay for treatment	3.67 ±0.79	69.3
A11	Willing Home treatment in appropriate cases	3.86 ± 0.77	73.0

Half of the participants reported being in close contact (less than 1 meter) with others during working hours. Regarding individual responses, all workers (100%) wore masks, and 88.7% indicated that their workplaces had mask-wearing regulations in place. During the crisis, 87.7% of employees reported completing health declarations, with 43.3% using paper forms, 42.3% using mobile applications, and 2% utilizing both methods. Additionally, over one-third of employees conducted self-testing for COVID-19.

Table 6. *Individual response in the workplace during the COVID-19 pandemic (n=300)*

Characteristics	Number	Percent
Setup the application for COVID-19 control		
Application for smart city (Hue- S)	170	56.7
Electronic health book (SSKĐT)	52	18.0
PC COVID	41	13.7
Disease control card	291	97.0
Health declaration at working places	263	87.7
Paper	130	43.3
Application	127	42.3
Both	6	2.0
Frequent health declaration		
Daily	242	80.7
Sometime	21	7.0
Wearing mask	300	100.0
Cloth mask	93	31.0
Medical mask	257	85.7
Wear a mask while working		
Obligatory	266	88.7
Non-obligatory	34	11.3
Distancing during working		
< 1 meter	120	40.0
1-2 meters	39	13.0
>2 meters	131	43.7
No direct contact	10	3.3
Self testing COVID-19		
Yes	101	33.7
No	199	66.3

Nearly 95% of participants believed that COVID-19 directly affected their income, leading to a 76.3% reduction in customers. The pandemic also negatively impacted the mental health of 56.3% of participants and caused delays in health examinations for 44% of them.

Table 7. *Impact of COVID-19 on employment income (n=300)*

	Impacts of COVID-19 pandemic	Number	Per cent
Income	No impact	16	5.3
	Loss lower than 50% of income	130	43.3
	Loss of 50 – 75% of income	97	32.3
	Loss of over 75% of income	56	18.7
	Increase the income	1	0.3
Others impact	Materials of agriculture	40	13.3
	Food Input sources	63	21.0
	Close workplaces	85	28.3
	Logistics and distribution of food	117	39.0
	Reduce the customers	229	76.3
	Others	5	1.7
health services	Delay in health examination	122	44.0
	Impact of treatment delay	42	14.0
	Negative impact on mental health	169	56.3

3.2 Rapid assessment of COVID-19 at workplaces of the food supply chain in Hue city

We found that almost all production facilities were small business models with less than 10 employees; by contrast, the highest facilities were markets, and 9 of the 28 facilities had more than 100 employees. Currently, 100% of workers were injected with at least the first dose of COVID-19, including 88,9% of workplaces where employees had been vaccinated at least two doses. Household, cooperative agriculture models, and limited companies were three common business models in the food supply chain.

Table 8. *Characteristics of workplaces and impacts of COVID-19 (n=28)*

Characteristics		Number	Per cent
Number of employees	Less 10	5	17.9
	11- 50	8	28.6
	51 – 100	6	21.4
	>100	9	32.1
Environment	Open	24	85.7
	Closed	4	14.3
Models	Household/ Individual	4	14.3
	Cooperative agriculture model	7	25.0
	Limited company	6	21.4
	Markets	15	50.0
Vaccine situation of facilities	85% of employees	1	3.7
	95% of employees	2	7.4
	100% of employees	25	88.9
Closing caused by COVID-19	None	16	57.1
	Less 7 days	6	21.4
	7 – 14 days	1	3.6
	15 – 30 days	5	17.9
Infected cases (related to the facilities)	None	14	50.0
	Less than 10	7	25.0
	11-50	5	17.9
	>50	2	7.1

Responses of workplaces toward the COVID-19 disease

Almost all workplaces required for environmental sanitation accounted for 82.1%; provide hand sanitation (78.6%); health declaration (71.4%). The lowest response rate toward COVID-19 was related to available areas for rest or self-quarantine.

4. Discussion

The current study was conducted during the fourth wave of COVID-19 in Vietnam [9]. The literature indicated a variety of evidence of the effects of COVID-19 on food supply chains. As suggested by the WHO, public cooperation is crucial in containing the spread of the outbreak and fighting against the pandemic calls for sustained efforts and constant vigilance. Therefore, evaluating public awareness and behavior is of great importance [10, 11]. The COVID-19 pandemic led to the disruption of the food supply chain for the market in Hue City, Vietnam. Among 12 of the total 28 facilities involved in the survey were closed under the effects of the pandemic and half of the facilities had appeared infected cases with COVID-19 diseases. This study highlights the significant challenges COVID-19 has posed to the Hue City food supply chain, a finding consistent with other studies on the impact of the pandemic on food security and supply chain continuity. The closure of 42.9% of establishments and the infection of workers

reflect the severe disruptions previously documented in food systems studies in developed and developing countries. The previous studies in Bangladesh and South Africa have observed similar challenges, including high rates of establishment closures and reduced labor productivity, undermining resilience across the entire food supply chain [2, 3].

COVID-19 disease spreads directly through contact between humans through small liquids and close connections. Moreover, the local government and employment implemented many priority policies for these workers to get vaccinated, particularly in the vulnerable groups and the essential fields. The COVID-19 vaccine was not recommended for young children in Vietnam (less than 12 years old).

These findings suggest that employees still lack sufficient understanding of the COVID-19 pandemic and how to respond. In the occupational settings of the food supply chain, maintaining physical distancing as recommended by the WHO and MOH is challenging, particularly in slaughterhouse markets. The majority of participants either agreed or strongly agreed with the COVID-19 prevention measures implemented by the local authorities and the Vietnamese government.

The results of the Knowledge, Attitudes, and Practices (KAP) survey are consistent with findings in other studies on the knowledge levels of food supply chain workers. Similar to studies conducted in China and the United States, this study found that while awareness of COVID-19 prevention was high, detailed knowledge of the causes of the disease was limited, with only 48.3% of participants correctly identifying the cause of COVID-19. In comparison, Fang et al (2021) noted that approximately half of the participants demonstrated partial knowledge of the causes of COVID-19 in a similar workforce context, reinforcing the need for targeted health education in the supply chain [11]. However, high compliance with mask-wearing measures (100%) and mandatory mask-wearing in 88.7% of workplaces in this study indicate an encouraging commitment to preventive behaviors, similar to findings in South Africa and Bangladesh, where mask-wearing compliance was at comparable levels [2, 3]. Recent studies have saided concer that poor knowledge, negatively skewed attitude, and poor practice regarding the COVID-19 pandemic were indicated. Therefore, health education programs aimed at mobilizing and improving COVID-19-related knowledge, attitude, and practice are urgently needed, especially for those who are illiterate, have travel and contact history, or generally among underprivileged populations [12]. In South Korea, a high prevalence of misunderstanding was discovered in knowledge items, with participants believing that infection could occur through eating or having contact with wild animals [13].

The economic and mental health losses observed among workers in Hue mirror those reported globally. Nearly all participants (95%) reported a loss of income, a finding echoed in other studies, such as Pollard et al (2020), who observed a direct impact on the livelihoods of food workers due to working hours, wages, and disruptions to operations [1]. This study also found that more than half (56.3%) of participants experienced negative impacts on mental health, highlighting the need for mental health support as part of the response, as suggested in previous literature that the mental stress experienced by essential workers facing similar economic insecurity and health risks. In addition, nations' COVID-19 situation and prevention strategies were contributed to explain the disparities.

We evaluated the coping for the COVID-19 pandemic of employment in the food supply chain based on the rapid assessment tool. The current research combined direct observation and interviewing the related people in workplaces. Unfortunately, many workplaces in food supply chains for Hue markets have closed because of the vast impacts of the COVID-19 pandemic. A total of 28 facilities in this chain were involved in the Rapid assessment. Maintaining physical distancing, as the WHO and MOH recommended, is challenging in workplaces, especially slaughterhouses and markets. Half of the participants reported being in close contact (less than 1 meter) with others during working hours. These findings echo those from studies

of people working in the food industry in close-contact settings. Similar studies in Bangladesh noted that structural and spatial constraints impeded adherence to social distancing in food markets and slaughterhouses, reinforcing the importance of reassessing safety protocols in such settings [2]. This study found that half of the participants worked in close contact (within one meter), highlighting the difficulty of meeting WHO and MOH guidelines in traditional market infrastructure. According to the guidance for food business, WHO and FAO indicated that physical distancing is critical to help slow the spread of COVID-19. All food businesses should follow physical distancing guidance as far as reasonably possible. WHO guidelines are to maintain at least 1 meter (3 feet) between fellow workers [6].

5. Conclusion

This study highlights the urgent need for context-specific adaptations in Hue City's food supply chains to address pandemic risks effectively. 42% of workplaces were closed during the pandemic, and half of the facilities appeared to have cases of COVID-19 infection. 56.3% of workers in this chain experienced a decline in mental health, while 44% faced delays in undergoing health examinations due to the COVID-19 pandemic. Enhanced health education, mental health support, and adaptive facility designs aligned with a One Health approach can strengthen the resilience and security of food supply chains against future public health crises.

References

1. Pollard CA, Morran MP, Nestor-Kalinoski AL. The COVID-19 pandemic: a global health crisis. *Physiol Genomics*. 2020; 52(11): 549-557.
2. Alam GMM, Khatun MN. Impact of COVID-19 on vegetable supply chain and food security: Empirical evidence from Bangladesh. *PLoS One*. 2021; 16(3): e0248120.
3. Njomane L, Telukdarie A. Impact of COVID-19 food supply chain: Comparing the use of IoT in three South African supermarkets. *Technol Soc*. 2022; 71: 102051.
4. Zinsstag J, Kaiser-Grolimund A, Heitz-Tokpa K, et al. Advancing One human–animal–environment Health for global health security: what does the evidence say? *The Lancet*. 2023; 401(10376): 591-604.
5. Häsler B, Bazeyo W, Byrne AW, et al. Reflecting on One Health in Action During the COVID-19 Response. *Front Vet Sci*. 2020; 7: 578649.
6. WHO, FAO. COVID-19 and food safety: guidance for food businesses. WHO. 2020.
7. WHO, Unicef, CIFRC. COVID-19 preparedness & response. 2021.
8. WHO. Critical preparedness, readiness and response actions for COVID-19. WHO. 2021.
9. Le HNM, Nguyen KQ, Le TN, Phan NQK, Nguyen TH. COVID-19 Timeline of Vietnam: Important Milestones Through Four Waves of the Pandemic and Lesson Learned. *Opinion. Frontiers in Public Health*. 2021; 9.
10. WHO. WHO Director-General's Opening Remarks at the Mission Briefing on COVID-19. *https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-27th-tripartite-annual-executive-committee-meeting-world-organisation-for-animal-health-oie-17-february-2021*.
11. Fang Y, Liu P, Gao Q. Assessment of Knowledge, Attitude, and Practice Toward COVID-19 in China: An Online Cross-Sectional Survey. *Am J Trop Med Hyg*. Feb 19 2021; 104(4): 1461-1471.
12. Gebretsadik D, Gebremichael S, Belete MA. Knowledge, Attitude and Practice Toward COVID-19 Pandemic Among Population Visiting Dessie Health Center for COVID-19 Screening, Northeast Ethiopia. *Infect Drug Resist*. 2021; 14: 905-915.
13. Lee M, Kang B-A, You M. Knowledge, attitudes, and practices (KAP) toward COVID-19: a cross-sectional study in South Korea. *BMC Public Health*. 2021; 21(1): 295.