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COVID-19 AND
EMERGENCY FOOD
SECURITY POLICIES
IN URBAN CHINA

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Abstract

The COVID-19 pandemic has continued to spread worldwide, threatening people's health as well as their food security. Yet, empirical research investigating its impacts on food security is scant. Limited attention has been paid to the local food security management implications of an infectious disease pandemic. To narrow these gaps, this study investigated the development of emergency food policies in Wuhan and Nanjing in China and households' food security, based on a combination of online surveys of household food security and policy document analysis. This study shows that COVID-19 and associated quarantine measures caused many households to experience food insecurity. There was also a notable increase in the number of severely food insecure households. We argue that the existing food contingency plans put in place were not adequate to handle the food security emergency caused by COVID-19. Although policies developed prior to the outbreak of COVID-19 to ensure food availability, utilization and containing food price had worked well, policies ensuring physical access to food outlets were far from adequate. The major lesson learned is that a more resilient system of food distribution is needed, including a relatively closed and independent home delivery system. Moreover, it is necessary to integrate grassroots organization such as residential community committee and property management organizations, and incorporate spontaneous volunteering management, in contingency food planning.

Keywords

COVID-19, food insecurity, food access, contingency policy, city region

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Introduction

There is a general consensus that COVID-19 has had a profoundly negative impact on food security, despite the overall resilience of international and internal food supply chains (Clapp and Moseley 2020, Galanakis 2020, Laborde et al 2020, Reardon and Swinnen 2020, Reardon et al 2020, Workie et al 2020, Zurayk 2020). The Committee on World Food Security has even suggested that the world now faces a “twin pandemic” of COVID-19 and food and nutrition insecurity (HLPE 2020). The impacts are being especially felt at the sub-national level in towns and cities where economic activity has been curtailed, unemployment has grown, and incomes and purchasing power have consequently declined in both the formal and informal sectors (Ben Hassen et al 2020, Corburn et al 2020, Farrell et al 2020, Iheme et al 2020, Ruszczuk et al 2020, Zidouemba 2020). Globally, communities that depend on migrant remittances for livelihoods and food purchase have particularly suffered (Diao and Wang 2020, Gupta et al 2020, Orozco 2020, Sirkeci 2020). It is also clear that public health policies to control the spread of infection have directly impacted on urban food systems in various ways including through temporary or permanent closure of food retail outlets such as public markets, supermarkets, and street food vendors; restrictions on consumer physical access to food through lockdowns, quarantines and stay-at-home orders; and the absence or presence of effective food emergency preparedness strategies (Arndt et al 2020, Cardwell and Ghazalian 2020, Crush and Si 2020, Darma et al 2020, Mishra and Rampal 2020, Woertz 2020). This paper focuses on the last issue by examining the nature and effectiveness of food emergency/contingency planning and the measures put in place in China in the first phase of the pandemic.

Over the past two decades, there have been increasing calls for more attention to be paid to food emergency/contingency planning, as the impact of environmental or socio-political disruptions on food security is much more severe than conventionally assumed (Kinsey et al 2019). Previous studies of food management response during periods of crisis

or natural disaster tend to focus on the immediate efforts of governments and international agencies to ensure food availability through continuity of production and food access through emergency food aid and distribution (Douglas 2009, Pingali et al 2005, Skees 2000, Wentworth 2020). The oldest proactive preparedness strategy involves the building of food reserves (Fraser et al 2015, Lassa et al 2019, Kinsey et al 2019, Smith and Lawrence 2018). Countries such as Ethiopia, for example, established a food security reserve system as early as 1982 in response to persistent drought and famine (Jones 1994). More recently, in the aftermath of the 2008 world food crisis, some Asian governments improved and strengthened their emergency food reserve system, not simply with disaster risk reduction in mind but also as a buffer for price shocks, climate change and food trade disruptions (Belesky 2014, Lassa et al 2019). In addition to national food reserves, countries such as Germany have called for citizens to store enough food and water for about 10 days (Gerhold et al 2019). In countries such as the United States (Kinsey et al 2019) and Australia (Smith and Lawrence 2018), food is not commonly incorporated into emergency response planning, leading some to advocate community-level food stockpiling (Berger 2019).

According to Jackson et al (2020), understanding the nature and root causes of food system vulnerability is a prerequisite for effective disaster preparedness and management. While there have been some studies of food supply chain resilience and vulnerability, they tend to focus more on conceptual and definitional issues (Béné 2020, Tendall et al 2015, Umar et al 2017). There have also been some studies of the volume of and types of items commonly included in food reserves (Estrada et al 2016, Wentworth 2020, Wien and Sabate 2015), but the piecemeal integration of food reserves into disaster preparedness planning complicates the management of food access during actual emergencies. Several challenges have to be overcome for effective relief. First, physical access to food outlets is critical during an emergency, and it is now standard practice to establish one or more distribution centres for emergency food relief after a disaster (Colon-Ramos et al 2019). However, this is only feasible if people are

able to access these centres. Extreme emergencies, transport disruption or quarantine measures (as in COVID-19 lockdowns) may limit or deny people's physical access to distribution centres. Second, the need for vertical cooperation and horizontal collaboration is essential (Smith and Lawrence 2018). Vertical cooperation includes cooperation between central, local and other levels of government; and horizontal collaboration includes public, private and civic actors (Smith and Lawrence 2018). Third, the allocation of responsibilities is another challenge in emergency food management. Complementing governmental emergency food supplies, charitable emergency food provision has often filled the gaps in public provision including in the United States, the United Kingdom and Canada (Lambie-Mumford 2013).

Empirical studies of emergency food management policy have focused on natural disasters such as flooding (Smith and Lawrence 2018), hurricanes (Colon-Ramos et al 2019) and other extreme climate events (Lassa et al 2019). With the notable exception of work on food policy responses to the ongoing global HIV and AIDS pandemic (Crush et al 2011, Loevinsohn and Gillespie 2003, Ivers et al 2009, Kadiyala and Gillespie 2004), limited attention has been paid to the local food security management implications of an infectious disease pandemic. Huff et al (2015) did find that the US food system was woefully underprepared for a future pandemic. And Ekici et al (2014) provide a simulation model for food distribution planning during a severe influenza pandemic. Rapid response investigations of food security policy responses to COVID-19 are beginning to emerge (Aday and Aday 2020, Akseer et al 2020, Arndt et al 2020, Mishra and Rampal 2020). However, more systematic research on food management policies and responses to COVID-19 are clearly necessary for a fuller understanding both of the effectiveness of pre-existing preparedness planning and the implementation of emergency food policies during the pandemic.

In this respect, the Chinese case is of particular relevance not simply because it is the first place where food systems were put under severe strain by the

COVID-19 pandemic but also because planning for and responding to the challenge of food insecurity was an early and central feature of the Chinese response, offering clear lessons for other areas of the world still in the grip of the pandemic (Crush and Si 2020, Fan 2020, Pu and Zhong 2020, Wang et al 2020, Yu et al 2020). This paper focuses on the city of Wuhan, and the neighbouring city of Nanjing. These two cities adopted different strategies to control and prevent the spread of COVID-19. Wuhan, for example, implemented a strict lockdown policy that prohibited movement of the populace in and out of the city and required residents to remain at home for an extended period. Nanjing adopted a less strict "first-order" quarantine response, including intensified virus testing, reduction of gatherings and asking residents to stay home. As this paper makes clear, these different strategies had different implications for food access and food system management. By comparing policy responses in Wuhan and Nanjing, this paper makes clear that the suite of responses to COVID-19 varied with the type and severity of the measures taken to contain the spread of the virus. Both cities had pre-coronavirus food security contingency plans in place. However, COVID-19 was an unprecedented challenge and confinement of millions of people in residential communities was an unprecedented policy response. As a result, additional strategies and resources were mobilized to deal with the sudden disruption of mobility and the established food system. The question is whether these measures ensured continued access to food, whether there were gaps between food security challenges and contingency responses, and what lessons can be drawn for urban food system management.

The four pillars of food security provide a lens through which the impacts of the pandemic and policy responses can be observed and analyzed. Food security is commonly defined as follows: "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (World Food Summit 1996). The four pillars or dimensions of food security are food availability, accessibility, utilization, and stability of the first

three pillars (FAO 2008). Food availability and access are the two key aspects of food insecurity in an emergency context (Smith and Lawrence 2018). Food accessibility includes economic and physical access (FAO 2008). Economic access to food or food affordability is often measured as the ratio of the food cost of a household relative to its income (Lee et al 2013). Food price and a household's income are the determinants of food affordability. Either the increased food price or income loss or both lead to a decrease in households' food affordability. Food production, stock and trade are the three main aspects determining food availability (FAO 2008). Those factors influencing food preparation and feeding practices determine food utilization (FAO 2008), including energy provision for cooking and clean water for drinking.

Methodology

Wuhan, the capital city of Hubei province, is located at the middle reaches of the Yangtze River and is divided into 13 districts (county-level administrative units). The administrative area of Wuhan is 8,569km² with 2,976km² of farmland (or about 35%) in 2016. There were 10.9 million residents and 8.5 million of residents with local household registration in 2017 (Wuhan Statistics Bureau 2018). Wuhan is where COVID-19 was firstly detected in China. The total official number of people infected in the city by April 10, 2020, was 50,008 (National Health Commission of China 2020). Nanjing is the capital of Jiangsu province, located at the lower reaches of Yangtze River, 500km north-east of Wuhan, with 11 districts. The administrative area of Nanjing is 6,587km² with 2355.8km² of farmland (about 36%) in 2018. The total population was 8.44 million, including 6.97 million of residents with local household registration in 2018 (Nanjing Statistics Bureau 2019). The cumulative number of infected persons was officially less than 100 by April 10, 2020 (Nanjing Municipal Government 2020).

Because of Wuhan's lockdown and the residential quarantine in Nanjing, a face-to-face survey was impossible. Instead, an online questionnaire was

developed and posted on the online survey platform *Wenjuanxing*. Respondents in the two cities were recruited through social media. An unexpectedly large number of responses was received. The questionnaire link was opened 6,409 times, and 2,363 people completed the survey. Of these, 1,445 were in Nanjing and 918 were in Wuhan. In cleaning the data, cases with a survey response time of less than 150 seconds were dropped, leaving 1,822 usable responses (796 from Wuhan and 1,026 from Nanjing). For the analysis in this paper, we also draw on the results of an earlier random citywide survey about household food security in Nanjing, conducted in July 2015, with 1,210 households. To measure levels of household food security, we used the Household Food Insecurity Access Scale (HFIAS) and the Household Food Insecurity Access Prevalence (HFIAP) indicator; both international cross-cultural metrics developed by the Food and Nutrition Technical Assistance (FANTA) project (Coates et al 2007, Swindale and Bilinsky 2006). There are some limitations to the data reported in this study. As the questionnaire survey of household food security was conducted through online self-reporting rather than onsite interview, the survey was not based on random sampling. A study of food security of households using emergency food assistance in the United States indicated that there was over-reporting of food security among program participants (Heflin and Olson 2017). This is possible here too given that the survey results indicated a very high level of anxiety of food shortage while the percentage of households that actually ran out of food was much lower (see below).

To investigate the development and implementation of food emergency policy, we collected and reviewed a selection of policy documents from government websites. The documents are pertinent to food security and emergency response, and most had been developed since the COVID-19 outbreak. These policy documents come from websites of the central government, Hubei Provincial Government, Jiangsu Provincial Government, Wuhan Municipal Government and Nanjing Municipal Government. In addition to those websites, we collected information and some data from newspaper websites, such as the number of public markets in

operation during the pandemic. “Public markets” (*nongmao shichang* in Chinese) are markets designed for anyone (commonly vendors in urban areas and farmers in rural areas) to sell fresh vegetables, fruits, meat and aquatic products. These markets are publicly or privately-owned (Zhong et al 2019).

Institutional Framework for Emergency Food Supply in China

After the SARS outbreak in 2003, contingency plans for daily necessities including food were established for every level of government in China. At the central government level, there are three sets of regulations pertinent to food contingency management, relating to grain and non-grain food, respectively. The non-grain food contingency management policy was first issued by the Ministry of Commerce in 2003 in the form of Contingency Management of Daily Necessities (CMDN) regulations. In 2011, the Ministry amended the CMDN, establishing the current regulatory structure of non-grain food contingency management for meat, vegetables, eggs and dairy products. The plan specifies four grades of response to cope with emergency situations—roughly corresponding to national, provincial, prefectural and county-wide emergencies. Regulations about grain and cooking oil contingency management were issued by the State Council in 2005, labelled the State Grain

Contingency Plan. In 2006, the Ministry of Commerce issued the Central Regulation of Frozen Meat Reserve policy. These sets of regulations form the institutional framework for the central and provincial governments to take their role in ensuring food supply in emergency conditions.

Broadly speaking, emergency food management in China has four components: food reserve management, contingency plan formulation, food price and sales monitoring, and contingency plan activation. Food reserves are an important part of food contingency management with seven food types commonly included: grain, cooking oil, meat, vegetables, eggs, sugar, and tea (Table 1). These are held in reserve by different levels of government. Grain and cooking oil are reserved from county-level all the way up to the central government. Vegetables, sugar and eggs are reserved by prefectural and county-level governments only (Table 1). There are also three kinds of contingency plan: a grain contingency plan, meat contingency plan, and daily necessities contingency plan. A contingency response can be triggered by the following types of events: natural disasters (such as earthquakes, mud slides and floods), emergency public health events, animal or plant epidemics, a war, or terrorist attack (Ministry of Commerce of China 2011).

The third component of emergency food management concerns food price and sales monitoring. A rapid increase in food prices or sudden food shortages can trigger the implementation of a food contingency plan. There are seven main types

TABLE 1: Food Reserve System in China

Food item	Department in charge	Level of government			
		Central	Provincial	Prefectural	County-level
Grain	Grain administration	√	√	√	√
Cooking oil	Grain administration	√	√	√	√
Meat	Commerce administration	√	√	√	
Vegetables	Commerce administration			√	√
Eggs	Commerce administration			√	√
Sugar	Commerce administration			√	√
Border-sale tea	Commerce administration	√	√	√	√

Note: √ indicates that there is a reserve established and managed at the government level. There are five level of administrative regions in China, including central, provincial, prefectural (the focus of this paper), county-level and township-level.
Source: Authors' compilation, based on pertinent laws and regulations.

of contingency food price measures (Ministry of Commerce of China 2011): (1) stabilizing food supply and price by intensifying market information release; (2) encouraging food enterprises to release their stock and speed food procurement to increase food supply; (3) transferring food from other regions; (4) releasing government food reserves; (5) organizing rapid food imports; (6) limiting the total amount for sale, potentially implementing food rationing; and (7) expropriating food and supplying it to the public. Finally, when a contingency plan is activated, releasing food reserves is one contingency measure but is not always triggered.

With the implementation of the lockdown in Wuhan on January 23, 2020, central government food contingency measures for the city were activated in two parts: (a) ensuring the food supply from other regions to Wuhan, and (b) food distribution inside Wuhan. Central government took responsibility for ensuring the supply of food to Wuhan and the Ministry of Commerce established a working team on January 23 to coordinate the supply of food to the city from nearby provinces. The central government reserved 10,000 tons of frozen meat for Wuhan on February 3, and 60,000 tons of vegetables were stored in nearby provinces for the Wuhan market (21st Century Business Herald 2020). A Joint Mechanism for Ensuring Food Supply Among Nine Provinces (including Hubei, Anhui, Jiangxi, Shandong, Henan, Hunan, Yunnan, Guangxi and Chongqing) was established on January 23 and formally announced on February 17. The Joint Mechanism assigned nine provinces the task of ensuring the supply of non-grain food

and grains to Wuhan, including vegetables, meat, eggs, milk, cooking oil, rice, wheat flour, and instant food (Ministry of Commerce of China 2020). Similar measures were not needed in Nanjing where the pandemic and disruption of urban food supply chains were less serious.

COVID-19 Emergency Food Policies in Wuhan

Prior to the COVID-19 pandemic, contingency food policies existed at the city level. In 2016, Wuhan Municipal Government had issued a Contingency Plan for Daily Necessities and Refined Oil. The Wuhan Municipal Commerce Bureau (part of the Wuhan Municipal Government), also issued a contingency implementation plan. Daily necessities defined by the two plans include grains, cooking oil, meat, eggs, vegetables, salt, sugar, bottled drinking water, instant noodles, and sanitary products. The contingency measures include information disclosure, enterprise procedure responses, interregional coordination, releasing food reserves, and establishing temporary commercial sites of food. The two plans also allocate the responsibilities between government departments and state-controlled companies. In particular, the implementation plan identifies roles for four companies in food contingency action (Table 2). The involvement of state-controlled and privatized companies demonstrates the social responsibility of state-controlled supermarket companies to increase the speed and reliability of any contingency response.

TABLE 2: Companies with Special Roles in Food Contingency Planning in Wuhan

Company	Ownership structure	Number of shops (or food items)
Wuhan Department Store Group Co., Ltd.	State-controlled by Wuhan Government (49.53%)	About 50 supermarket shops at Wuhan ^(a)
Zhongbai Holdings Group Co., Ltd.	State-controlled by Wuhan Government (49.23%)	76 supermarket shops in 2018 ^(b)
Wuhan Zhongshang Commercial Group Co., Ltd	Change from state-controlled by Wuhan Government to privately-owned in 2019	21 supermarket shops ^(c)
Wuhan Non-staple Food Reserve Company	State-controlled company	Responsible for the reserve of pork, beef and mutton, and sugar ^(d)

Source: (a) https://www.tianyancha.com/company/2965477693?enterprise_full=true, (b) <http://dy.163.com/v2/article/detail/E6CU15J505381MHQ.html>, (c) <http://www.zhongshang.com.cn/about-distribution.aspx?nid=10006>, (d) <https://www.tianyancha.com/company/523583156>

TABLE 3: Timeline Emergency Food Policies in Wuhan

Date	Emergency food policies	Market
January 23, 2020	Mechanism of jointly ensuring the food supply among 9 provinces	• *
January 24, 2020		• *
January 25, 2020 (Spring Festival)	Central government established working team ensuring Wuhan food supply	• *
January 26, 2020		• *
January 30, 2020	Closure of public markets (More than 90% were closed)	• *
February 8, 2020	Reopening 14 public markets	o *
February 11, 2020	Limiting times for buying food (One person per household allowed out every 3 days)	o *
February 14, 2020	Abolishing regulation of one person per household allowed out every 3 days	o *
February 17, 2020	Community group buying policy -Online food buying -Group buying provided by supermarkets -Group buying provided by producers of produce -Food donation to low-income people	o *
February 19, 2020	Supermarkets only accept community group buying	o °
February 23, 2020	Policy to recruit food delivery volunteers	o °
February 29, 2020	Special offer and allowance -CNY 10 for 10 half kilograms of vegetables -CNY 10 for 1 half kilograms of pork -CNY 300-500 allowance to low-income households	o °
March 19, 2020	Restarting of public markets and other food stores (Where residential communities without epidemic risk)	• °
March 22, 2020	Supermarkets return to accepting individual shopping	• *

Note: • public markets in business, o public markets not in business; * Supermarkets accepting individual shopping, ° Supermarkets only accepting community group buying
Source: Compiled by authors based on Wuhan Municipal Government website

However, the lockdown policies to contain the spread of COVID-19 dramatically changed the city's food system and household physical access to food outlets. Min et al (2020) report that over half of food suppliers open for business between January 23, 2020 and February 23, 2020 did not have enough food sources compared to the same period in previous years, while 83% of food suppliers' revenue decreased compared to the same period in previous years. From January 23 to February 29, Wuhan's restriction policies escalated from closure of all public transportation, to no private vehicles without a special permit, then to partial enclosure of residential communities (neighborhoods), and finally to a complete enclosure of residential communities on February 14 (Table 3). Most urban households in China live in gated residential communities, which are relatively easy to lock down.

Any ungated communities were gated using construction hoardings. The lockdown policies also closed public markets (wet markets) temporarily from January 30. Partial residential enclosure was announced on February 11, 2020, which allowed one person per household to go out of their residence to buy food once every three days. After a week, the policy escalated to complete enclosure.

With complete enclosure of residential communities, people were prohibited from leaving their apartment buildings at all and had no direct access to their everyday food outlets. Wuhan's food distribution system was temporarily restructured with the objective of ensuring food accessibility for over 8 million residents in complete enclosure. A food provision policy called "community group buying" was put in place from February 17 to March 19

(Table 3). This policy involved four methods of food access (Hanyang District Government 2020): (a) online food buying where individual households bought food from an online retailer and picked up the food at a designated spot within the enclosed residential community; (b) group buying from supermarkets where residential or neighbourhood committees acted as food purchasing agents, collected the consumers' orders, then bought food from supermarkets and used government-allocated delivery services; (c) buying directly from producers; and (d) the allocation of food donations with priority given to low-income households, especially those households enrolled in the Minimum Livelihood Guarantee (*dibaohu*) programme implemented in urban areas since the 1990s (Kakwani et al 2019).

Community group buying faced two challenges. First, there was limited capacity for transporting food from supermarkets or producers to residential communities. Second, there was a shortage of labour for rapidly distributing food to buyers. The Wuhan government used buses and requisitioned some private vehicles to address the first challenge (Hubei Daily 2020). Paid and unpaid volunteers were recruited to address the second challenge. Volunteers were issued permits to leave and return to gated communities but mainly stayed away from their homes in hotels to reduce the risk of

transmission to their families and communities. Community group buying was implemented city-wide until March 19, 2020, when public markets and other food stores were allowed to re-open in areas where residential communities were classified as "communities without epidemic risk" (defined as having no confirmed, suspected or close-contact cases and no fever cases for a minimum of 14 days).

COVID-19 Emergency Food Policies in Nanjing

Four regulations and two contingency plans formed the pre-COVID institutional framework of emergency food supply management in Nanjing. The regulations included the Nanjing Regulation on Emergency Requisition Daily Necessities, the Nanjing Regulation on Grain Reserves, the Nanjing Regulation on Vegetable Reserve, and the Nanjing Regulation on Meat Reserves. The contingency plans were the Nanjing Contingency Plan for Daily Necessities and the Nanjing Contingency Plan for Grain, both released in 2018. The food reserves are operated by state-owned and privately-owned food companies (Table 4). Emergency situations are classified into four grades, mainly determined by the rate of food price increase and the number of days

TABLE 4: Quota of Food Reserve in Nanjing

Food item	Reserve quota	Reserve organization
Grain ^a	More than 3 months' demand	Nanjing Grain Company ^d (state-owned)
Cooking oil ^a	7,000 tons	Nanjing Grain Company ^d
Frozen pork ^b	1,800 tons	Jiangsu Foodstuff Group Co., Ltd. Yurun Holding Group Co., Ltd. BGX Logistics Development (Group) Co., Ltd. Tianhuan Food Group Co., Ltd. Lvliuju Food Company ^e (privately-owned)
Frozen beef	100 tons	Same as above
Pork	30,000 pigs (equivalent to 1,500 tons of pork)	Same as above
Beef	600 cattle	Same as above
Vegetables	Only in winter: 3,000 tons (in storehouse), 10,000 tons (on field)	Zhongcai Wholesale Market ^{c,e} (state-controlled)

Source: a) http://www.nanjing.gov.cn/zdgc/201512/t20151230_1056761.html, b) http://www.nanjing.gov.cn/zdgc/201810/t20181022_574116.html, c) <http://jiangsu.sina.com.cn/news/m/2016-12-27/detail-ifxyxusa5534141.shtml>, d) <http://wmdw.wmng.gov.cn/home/about/213782-444019.html>, e) http://swj.nanjing.gov.cn/bsfw/swfg/201711/t20171130_446772.html

without stock. The first grade is the most urgent and the fourth the least.

In contrast to Wuhan, Nanjing did not implement a complete lockdown policy primarily because there were many fewer cases of COVID-19. Three main measures were implemented to control spread: reducing people's mobility, restricting gatherings, postponing the date for resuming work after the Chinese New Year holiday (excluding government sectors) (Table 5). The critical difference with Wuhan is that the enclosure of residential communities was partial rather than complete. Residents were permitted to leave their residential communities (neighbourhood) to buy food. Nanjing also implemented special regulations on transportation, including compulsory body temperature checks upon entry or exit from the city, as well as a pass permit policy and stay-at-home order (Table 5). The pass permit policy in Wuhan prohibited people without a special permit from driving a vehicle. In comparison, the pass permit policy in Nanjing paced no restrictions on vehicles and persons issued with a permit for activities such as food transport.

Emergency food policies implemented in Nanjing between January 23 and March 28 focused on supporting food retailing operations and preventing the spread of the virus through food distribution. Public markets and supermarkets were excluded from the restrictions on work resumption, in order to enable these food outlets to continue to operate. Usually during the Chinese New Year holiday, supermarkets will keep operating and public markets will close. To ensure the re-opening of public markets, the Nanjing Municipal Government and its district (county-level) governments issued plans and policies for epidemic control and prevention for public markets. However, food retailing capacity in the markets was limited by the fact that more

than half of the food vendors in public markets in Nanjing are migrants to the city (Zhong et al 2019). Normally, most of these vendors go back to their hometown for the Chinese New Year celebration and return to work a week later. In 2020, however, they were required to self-isolate for two weeks when they returned to Nanjing and some food vendors could not, or were reluctant to, return to Nanjing because of the quarantine requirements and travel restrictions. To ensure that the markets resumed operations, governments at the city and district level issued plans and policies for epidemic control. These included intensification of sterilization efforts in marketplaces, crowd control, and reducing business hours (Table 5). The number of public markets that re-opened gradually increased from 112 on January 29 to 311 on February 24, and finally on March 21, 2020, all public markets in Nanjing resumed operations (Table 5). All the supermarkets have kept open. The Nanjing government also supported the resumption of restaurants. As online selling of cooked food needed a permit from the county-level Administration of Market Regulation, the administration transferred face-to-face application submissions to online submissions, ensuring that restaurants received permits for online selling rapidly.

Three types of temporary auxiliary food security policy were also implemented (Zhong and Scott 2020). First, shops selling food were permitted to enlarge their scope; for instance, fruit shops without a permit for selling vegetables were allowed to do so. Second, restaurants and food vendors were permitted to sell food in open spaces, such as in small plazas in front of residential neighbourhoods. Third, convenience stores were permitted to sell fresh vegetables and meat. All these policies were designed to ensure Nanjing households' access to fresh produce and cooked food.

TABLE 5: Timeline of Emergency Food Policies in Nanjing

Date	Emergency food policies of Nanjing	Number of public markets in business
January 23, 2020	Daily sterilizing of public markets	All
January 26, 2020	Intensification of sterilization efforts in public markets - Reaffirming prohibition on sales of live poultry & wild animals within public markets and supermarkets	0
January 28, 2020	No work/business resumption before February 9, 2020 (usually, the first 6 days of the lunar calendar are holidays in China) Commerce Bureau's plan of public markets' business resumption on January 29, 2020	Same as above
January 29, 2020	Guidelines for sterilizing public markets Issued by Jiangsu Provincial Commerce Department	112
	District governments issued guideline for public market epidemic prevention	
January 30, 2020		159
January 31, 2020	Intensification of food price surveillance and inspection	189
	Epidemic prevention for supermarkets, public markets, catering industry - Requirements for business resumption - Epidemic prevention measures for business time	
	Policy encouraging vegetable production Issued by Jiangsu Provincial Agriculture Department	
February 1, 2020	Stabilizing supply and price of grain & cooking oil Issued by Jiangsu Provincial Food and Strategic Reserves Administration	227
February 2	Policy of no dine-in - Date of this policy varies by urban district	240
February 3, 2020		258
February 4, 2020	Special policy of food retailing - Allowing public markets and supermarkets to continue operations - Everyone must wear a mask and do a temperature check when entering public markets and supermarkets - Periodic sterilizing of public markets and supermarkets	--
February 5, 2020	Policy for no-contact food delivery Issued by Jiangsu Administration for Market Regulation	--
February 7, 2020		283
February 10, 2020	Extension of the policy of no work/business resumption for catering industry (The dates of policy extensions vary by district)	293
February 11, 2020		301
February 17, 2020	Policies for non-grain food production and supply - Rent reduction: for food business, exemption from paying one month's rent; halving rent for 2 months (for state-owned property) - Subsidy: subsidizing online sales - Tax reduction for food production Crowd control - 1.5 metres physical distancing while shopping - Crowd control within public markets and supermarket	
February 18, 2020		309
February 20, 2020	Must do temperature check when enter public markets and supermarkets	--
February 24, 2020	Policy of work resumption for catering industry	311
March 3, 2020	Policy of resuming dine-in at restaurants	--
March 21, 2020	No longer checking temperatures in public markets and supermarkets	All
Note: All supermarket shops had kept in business. Traditionally, all public markets closed from the afternoon of January 24, 2020 (the last day of 2019 on lunar calendar) to January 29, 2020 due to the Chinese New Year holiday. -- Refers to no statistics figures. Source: Compiled by authors based on Nanjing Municipal Government website		

Comparing Alternative Models of COVID-19 Emergency Response

Both Wuhan and Nanjing mobilized existing contingency policies to ensure physical food access. However, the scope and intensity of the pandemic response demanded new and innovative food system management responses. Here, the two cities took different approaches: i.e. the community group buying method in Wuhan and the retail recovery method in Nanjing (Table 6). In Wuhan, the implementation of lockdown policy meant that access to food marketplaces and mobility was extremely limited. A community group buying policy was therefore introduced to offset the decrease in access to food marketplaces and mobility.

The strategy tried to build a contingency food retailing system by including supermarkets, community committees and property management organizations while excluding and closing public markets. However, this still meant reduced food retail service capacity compared to normal times when food retail is provided by supermarkets and public markets together. To narrow the food retailing capacity gap, Wuhan Municipal Government implemented the policy of recruiting unpaid volunteers to help distribute food that was transported to residential communities. Retail recovery in Nanjing focused on returning the food distribution system to normal as rapidly as possible by reopening public markets and keeping supermarkets in business while preventing food retailing employees from getting infected. Without a complete lockdown, Nanjing residents were also able to personally access food retail outlets, unlike in Wuhan.

Policy responses in Wuhan and Nanjing also had some similarities. Both developed policies to maintain food affordability, for example, but in different

ways. Nanjing intensified its food price monitoring to contain food price increases. The Wuhan Municipal Government provided about 130,000 vulnerable residents with temporary price subsidies since January, which is about CNY 330 (about USD 50) per capita per month (Beijing News 2020); especially those households enrolled in the Minimum Livelihood Guarantee (*dibaohu*) programme, which has been implemented in urban areas since the 1990s (Kakwani et al 2019). Furthermore, a series of “no stopping service” policies were put in place in both Wuhan and Nanjing, which were implemented as local then national policies. The policy of “no stopping/shutting off power, gas and water supply for those in arrears or running out of credit” thus ensured that all households have access to power and water for food preparation (Chutian City Daily 2020, Nanjing Daily 2020). The policy of “no stopping internet and mobile phone services for those in arrears or running out of credit” was also put in place for access to online food buying (Xinhua News 2020).

At the city level, COVID-19 thus prompted the implementation of different control and mitigation strategies. Some of these strategies directly impinged upon core elements of the food system in both cities, especially the distribution and retailing of food and the nature and type of ready access previously enjoyed by millions of city residents. Three questions arise: first, how were these disruptions, and the emergency policy responses to contain their impact, actually experienced by urban consumers? Second, did these measures impact on the food security and food consumption behaviour of consumers? And third, were there differences between Wuhan and Nanjing in these impacts and responses, given the documented differences in policy responses to the pandemic at the local level? These questions are addressed in the next section of the paper.

TABLE 6: Comparison of Food Policies Between Wuhan and Nanjing

	Wuhan (Community group buying strategy)	Nanjing (Retail recovery strategy)
Policy groups	Lockdown Stay home; not allowed outside No physical access to food outlets	No lockdown Stay home; must wear a mask when going out
Production	Work/business resumption of food/agriculture production since early February	Ensuring agricultural production and facilitating the transportation of agricultural inputs
Stock	Released food reserve	Increased food reserve
Trade	Central government responsible for food supply from outside Wuhan Mechanism of jointly ensuring food supply among 9 provinces	
Price	Making supermarket/retailing companies such as Wushang, Zhongbai, Zhongshang, Walmart, Carrefour and Wuhan rural e-commerce to contain food prices no higher than that in previous year Publishing information of food price Providing special-price (low price, reduced-price) food since March 3	Intensifying food price monitoring
Income	CNY 300-500 allowance for low-income households Food donation from farmers and others allocated to low-income household first	Implementing consumer price subsidy policies and low-income households receiving a food price subsidy Special allowance (cash and/or food) to those households and individuals that fall below minimum living standards
Access to markets	Community group buying Food delivery volunteers	Intensifying epidemic prevention inside markets Ensuring public market reopening Contact-free food and produce delivery No dine-in option at restaurants
Access to water & energy	No cessation of power, gas and water supply for those in arrears or running out of credit	No cessation of power, gas and water supply for those in arrears or running out of credit
Feature of policy	Government-led Vertical cooperation between governments for ensuring food provision Central government responsible for ensuring supply from outside Wuhan, local government responsible for food distribution Supermarkets took the leading role	Market-led method and government-regulated Local government responsible for ensuring food supply Highlighting the role of public markets
Source: Authors' compilation, based on pertinent laws, regulations and policy documents		

Household Food Security During COVID-19

To gauge how and how many residents of the two cities actually experienced the various emergency policies and the associated impacts of the pandemic, the online survey respondents were provided with a list of mobility and food-related challenges and asked if they had experienced any since the start of lockdown (Table 7). As expected, the residents of

Wuhan reported stricter controls and restrictions than their counterparts in Nanjing. For example, 60% of Wuhan residents experienced restricted access to food retail outlets compared to 34% of Nanjing residents. Also, 38% of Wuhan residents experienced restricted access to online food outlets compared to only 12% of Nanjing residents. There were also significant differences in restrictions on home delivery of food and in the freshness of food. Underlying these differences, and the different levels of general food insecurity, are differences

in food price increases and household income. As Table 7 shows, as many as 61% of Wuhan respondents reported food price increases, compared with 35% of Nanjing respondents. Also, 51% of Wuhan households reported loss of income due to COVID-19, compared to 20% of Nanjing households.

Change in availability and access to preferred foods, and reduced dietary diversity, are other potential consequences of an emergency such as

a pandemic. The consumption of particular food items was clearly affected to various degrees by the COVID-19 public health response in both Wuhan and Nanjing. In Wuhan, the percentage of households reporting food item consumption changes ranged from 6% for some food items to 44% for others (Table 8). More than 20% of households experienced a change in the consumption of most food items listed, with the greatest impacts on the consumption of fish (44%), beef and lamb (42%),

TABLE 7: Experiences of COVID-19 Challenges in Wuhan and Nanjing

Challenges	Wuhan (%)	Nanjing (%)
Restricted mobility	73.9	30.2
Food price increase	60.9	35.1
Restricted access to public markets and supermarkets	60.2	33.5
Loss of income due to COVID-19 restrictions	50.6	20.4
Restricted access to online stores	38.2	11.7
Food not fresh	38.1	16.2
Limited food availability and lack of food variety at online stores	34.4	17.2
Limited food availability and lack of food variety at public markets or supermarkets	32.8	26.7
Restricted food delivery to your home	25.6	9.2
None of the above	4.6	18.1
N	796	1,026

Source: Online survey conducted in 2020

TABLE 8: Impact of COVID-19 Measures on Household Consumption of Various Food Items

Food items	Wuhan (%)	Food items	Nanjing (%)
Fish	44.2	Vegetables	21.8
Beef and lamb	41.8	Pork	20.9
Pork	35.6	Fish	18.0
Bean products	33.8	Cereal	17.9
Fruits	31.7	Beef and lamb	16.1
Poultry	28.8	Poultry	14.4
Nuts	27.6	Fruits	13.5
Milk	25.4	Bean products	9.0
Offal	22.7	Tubers	8.9
Cereal	21.5	Milk	8.1
Vegetables	20.7	Melon	8.0
Beans	20.7	Offal	6.0
Melon	14.3	Beans	5.8
Tubers	13.1	Egg	5.6
Condiments	10.1	Nuts	4.3
Egg	7.9	Condiments	4.1
Oil and butter	6.3	Oil and butter	2.9
Total number of responses	796	Total number of responses	1,026

Source: based on online survey conducted in 2020

pork (36%), bean products (34%), fruits (32%) and poultry (29%). Overall levels of change in Nanjing were lower than in Wuhan with the exception of vegetables (22% versus 21% in Wuhan). While fish and meat products and fruits were most affected in Wuhan, vegetables and cereals were also relatively significantly affected in Nanjing.

The survey results indicated that overall levels of food insecurity increased in both cities at the height of the pandemic. A pre-COVID-19 household survey in 2015 found very low levels of household food insecurity in Nanjing (Si and Zhong 2018) (no comparable data exists for Wuhan). The average HFIAS score was only 0.61 (out of a possible 27) and the HFIAP typology showed that 79% of households were food secure with 5% moderately food insecure and just 2% severely food insecure (Table 9). By comparison, only 31% of households in Nanjing were food secure at the time of the survey compared with 19% moderately food insecure and 22% severely food insecure. This suggests that there was a significant overall deterioration in food security in the city during the pandemic with levels of complete food security declining from nearly 80% to just over 30%. While there are no pre-pandemic baseline figures for Wuhan, Table 9 clearly shows that the food security situation during the pandemic was worse than in Nanjing. Only 5% of households reported being food secure compared with 31% in Nanjing with 38% being severely food insecure, compared to Nanjing's 22%, suggesting that milder public health responses had less serious

consequences for household food security.

Table 10 (based on the nine frequency-of-occurrence HFIAS questions) provides further insights into how households experienced food access challenges in each city. Levels of concern about not having enough food were much higher in Wuhan (55%), but still close to one-third in Nanjing. A smaller percentage of households in both cities experienced an absolute shortage of food at some point (6% in Wuhan and 5% in Nanjing) or went to sleep hungry (11% in Wuhan and 6% in Nanjing). Food insecurity primarily manifested in households not having access to preferred foods, eating a limited variety of food (two-thirds of Wuhan residents and 25–30% of Nanjing residents), and having to eat unwanted food (40% in Wuhan). In Wuhan, around one-quarter of households had been forced to eat fewer meals or smaller meals. In Nanjing, by contrast, the figure was only 10%.

One common general indicator of a deteriorating food security situation is that a household spends a greater share of its income on food as food prices rise and income potentially falls. Figure 1 shows that in both cities, the majority of households spent more on food during the lockdown (82% in Wuhan and 64% in Nanjing). Around half of the households in both cities spent up to twice the usual amount on food with nearly 40% of households in Wuhan spending more than double the usual amount, while in Nanjing the figure was less than 15%.

TABLE 9: Levels of Food Insecurity in Wuhan and Nanjing

Categories	Wuhan in 2020		Nanjing in 2020		Nanjing in 2015	
	No.	%	No.	%	No.	%
Food secure	41	5.2	315	30.7	929	78.9
Mildly food insecure	124	15.6	297	28.9	162	13.8
Moderately food insecure	329	41.3	192	18.7	62	5.3
Severely food insecure	302	37.9	222	21.6	25	2.1
Total	796	100.0	1,026	100.0	1,178	100.0

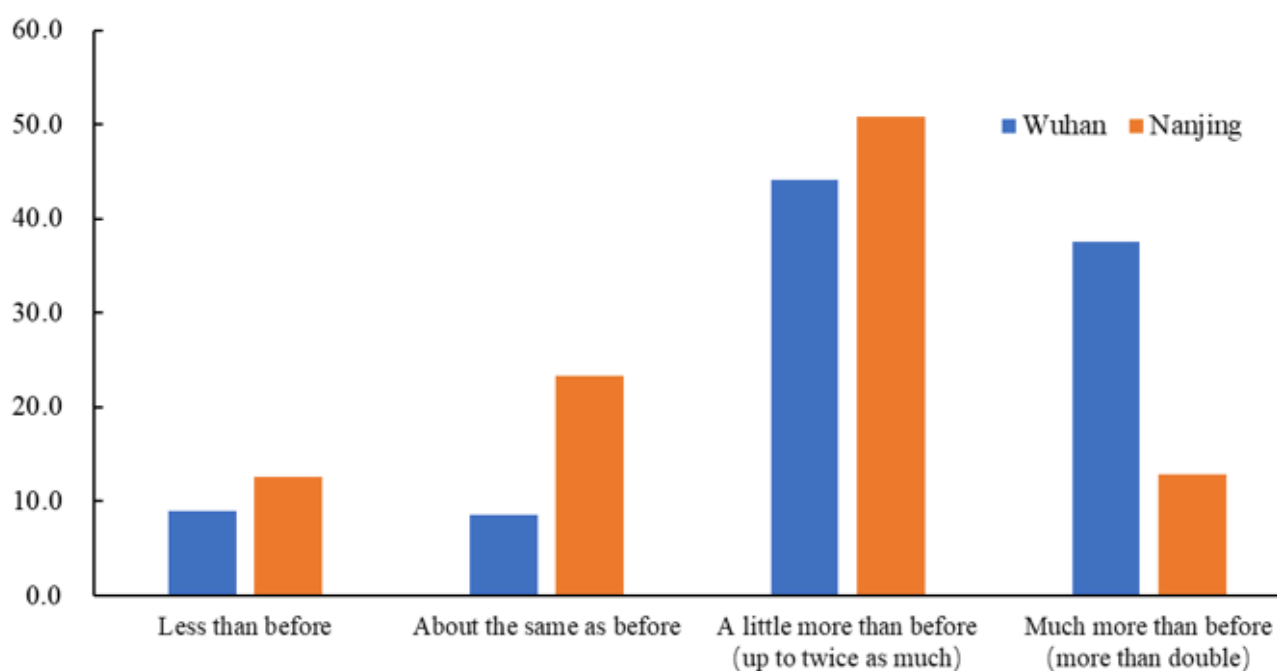
Source: Calculated from Si and Zhong (2018) and the online survey conducted in 2020

TABLE 10: Experiences of Food Insecurity in Wuhan and Nanjing

Items	City	Never	Rarely	Sometimes	Often	Always
Worrying about not having enough food	Wuhan	17.7	27.8	35.6	12.1	6.9
	Nanjing	41.8	28.6	23.3	4.0	2.3
Not eating preferred food	Wuhan	11.2	23.7	39.6	19.1	6.4
	Nanjing	38.7	30.7	23.3	5.1	2.2
Eating a limited variety of foods	Wuhan	10.9	23.0	33.7	23.5	8.9
	Nanjing	44.7	30.6	17.5	5.2	1.9
Eating unwanted food	Wuhan	26.9	33.5	26.9	8.9	3.8
	Nanjing	63.6	24.3	9.2	1.9	1.1
Eating fewer meals	Wuhan	47.2	25.0	16.6	5.5	5.7
	Nanjing	73.8	17.6	6.4	0.9	1.3
Eating smaller meals	Wuhan	50.0	25.4	17.1	4.4	3.1
	Nanjing	73.2	18.0	6.6	1.2	1.0
No food to eat of any kind in your household	Wuhan	70.0	17.6	8.8	2.3	1.4
	Nanjing	81.0	13.4	4.4	0.7	0.6
Going to sleep hungry	Wuhan	73.7	14.9	8.2	1.5	1.6
	Nanjing	83.4	11.1	4.6	0.4	0.5
Going a whole day and night without eating anything	Wuhan	82.9	10.1	4.5	1.5	1.0
	Nanjing	84.0	10.8	3.4	1.2	0.6

Source: Based on online survey conducted in 2020

FIGURE 1: Expenditures on Food Before and During the Pandemic



Conclusions

There are two major findings that emerge from this assessment of the food security impacts of COVID-19 in the two Chinese cities of Wuhan and Nanjing. First, COVID-19 and associated public health containment measures caused large number of households to become more food insecure. In particular, COVID-19 led to a significant increase in the number of severely food insecure households. This suggests that more attention should be paid to the issue of household food security impacts in every country where strict lockdown measures are implemented to control the spread of COVID-19. Second, continued access to food was a more urgent challenge than food availability in the immediate term. Government efforts to ensure food availability at the city region level were largely successful, but COVID-19 led to serious challenges in ensuring household-level access to food as a result of income loss, rising food prices, restrictions on physical access to food outlets, and problems with food distribution.

Although contingency plans for the food supply were established for China's cities in the aftermath of the 2003 SARS outbreak, none of these plans were designed to cope with the situation of a citywide lockdown or people having to be homebound. COVID-19 was thus an unprecedented challenge and confinement of millions of people in residential communities was an unprecedented policy response. Existing food contingency policies in Wuhan and Nanjing therefore had to be adapted to deal with the public health mitigation measures to control the spread and impact of COVID-19. Additional strategies and resources were mobilized in both cities to deal with the sudden disruption of mobility and the food system. Comparing policy responses in Wuhan and Nanjing, it is clear that the suite of responses to COVID-19 varied with the type and severity of the measures taken to contain the spread of the virus and this, in turn, led to different policy responses and food security impacts.

While food contingency plans are common across China, they were insufficient to handle the food

emergencies caused by COVID-19. Chinese city governments developed food contingency policies based on their existing food contingency plans and policies and the degree of COVID-19 impact. Wuhan adopted the "community group buying" method while Nanjing adopted retailing recovery method to ensure physical access to food. Although those policies focused on diverse aspects of food security, including food availability, food utilization, containing food prices, income subsidy and ensuring physical access to food, there were weaknesses. Both methods were not able to restore the level of access to food to normal. The major lesson learned is that a more resilient system of food distribution is needed, including a relatively closed and independent home delivery system. Moreover, government cannot do this on its own. Going forward, it is necessary to integrate grassroots organizations such as residential community committee and property management organizations, and spontaneous volunteering management, into contingency food planning.

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