Study on vegetable emergency support technology under epidemic

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Abstract: As an important nutrient source in the diet of residents, vegetables are an important guarantee to enhance immunity. The outbreak of COVID-19 has led to labor restrictions, poor logistics and transportation, and changes in residents' consumption and eating patterns, which have challenged the traditional supply model of vegetables. In response to this challenge, this study analyzes the outbreak of vegetables reserves, distribution, supply, quality and safety and the influence of supply mode in five aspects. It also analyzes how to carry out technical research in order to make timely adjustments to the supply mode of vegetable products and ensure the residents' vegetable supply.

1. Introduction
Vegetable is a kind of high frequency consumer product necessary for people's livelihood. Its rich nutritional value is an important guarantee to improve the national resistance. After the outbreak of the epidemic, it became more difficult to get vegetables out of the village, onto the road and into the city, and the cost of every link from the field to the table increased[1]. Changes in supply and demand relations, agricultural capital costs and circulation system will affect vegetable prices[2]. During epidemic outbreaks, all over the country village, road and traffic control, lead to planting base of vegetables transported out, dealers logistics transportation channel impeded, the traditional model of supply chain rupture, vegetable products cannot be promptly sent to the hands of residents, appeared a surplus vegetables rotting in the fields or even business warehouse, and the contradiction that residents "have no food to eat" phenomenon.

Therefore, how to guarantee the price and quality of "vegetable basket" in the state of emergency and realize safe, convenient and fresh supply is an urgent problem to be solved.

2. Analysis of vegetable supply security under the epidemic situation

2.1. Reserve varieties are few and difficult to reserve
The production of vegetables has strong regional and seasonal characteristics, and the storage period of vegetable products is short, so the preservation technology must be applied to the preservation of vegetables, greatly extending the preservation period of vegetables. However, due to the limitation of the preservation technology, the vegetable varieties suitable for storage are still limited to potatoes, carrots, yams and other stem vegetables.
2.2. Supply channels are blocked and vegetable prices fluctuate
Affected by the outbreak, vegetable supply channels have been blocked. First, because vegetables are labor-intensive, production was restricted during the epidemic in order to reduce the movement of people. Second, road traffic control has been carried out in many places, and villages have been closed off in some places. As a result, vegetables from the planting bases cannot be transported out, distributors have poor logistics and transportation channels, and traditional supply chains have broken down, making it difficult for farmers to sell vegetables and residents to buy them. Third, during the epidemic, the relevant departments have increased the quarantine on product transportation, the transportation time has been extended, and the sales channels of vegetables have been greatly hindered. The outbreak of the epidemic has changed many links of vegetables from raw material collection to processing and production, and the price of vegetables has fluctuated. From Fig1, it can be seen that the price changes of some vegetables for 12 consecutive weeks from January 24, 2020. It can be seen from the figure that in the first half of February at the beginning of the epidemic outbreak, the prices of potatoes, cabbages, onions and pumpkins increased, while the prices of tomatoes also increased in early February after a decrease at the end of January. Later with the warm weather and the introduction of relevant government policies, vegetable prices began to fall.

![Fig1. Changes in vegetable prices in the 12 weeks of 2020](image)

2.3. Changes in consumption patterns
The outbreak of the epidemic has changed the way people consume. With the change of consumption mode, higher requirements are put forward for the safe distribution of vegetable products.

2.4. Changes in dining trends
During the epidemic, in order to reduce the gathering of people, many residents no longer eat out. The current supply of vegetables is still dominated by woolen cabbage, and consumers need to spend a lot of time processing the ingredients before cooking, further washing, peeling, and cutting the ingredients, which brings a lot of inconvenience to consumers. At the same time, the fast-paced life has allowed more and more consumers to pursue fast, nutritious and delicious diets.

3. Technical research on vegetable supply security under the epidemic situation

3.1. Technical Route
The technical route is shown in Fig2.
3.2. Technical Proposal

3.2.1. Establishment of vegetable emergency production guarantee system
In order to increase the reserve of vegetable products during the epidemic, it is necessary to conduct research on vegetable planting and processing. The research contents include: (1) Select vegetable varieties with short maturity period, high yield, nutritious and delicious, and easy to grow; (2) According to vegetable varieties Characteristics, growth cycle, environmental conditions, choose protected planting, open-field planting, soilless cultivation and other vegetable planting modes; (3) Reasonable layout of planting base[3]. Strengthen cooperation with surrounding areas, and realize the reasonable mix and connection of planted varieties; (4) Formulate prevention and control guidelines and safety production and hygiene regulations for vegetable processing enterprises.

3.2.2. Establish a vegetable safety distribution system
In order to respond to changes in consumption patterns and meet residents’ needs for purchasing vegetable products, advanced visualization and digitization technologies can be adopted to establish a vegetable safe distribution system and form a standardized operation procedure.

Fig2. Technology roadmap

Fig3. Establish a vegetable safe distribution system
(1) Conduct safety management and monitoring of the harvesting process[4]; (2) Install hd camera,
GPS and Internet of Things sensors on the refrigerated vehicle to monitor and trace the source of vegetable transportation. Monitor and upload the control information to the cloud via the Internet. Meanwhile, the relevant key node information is stored in the blockchain for non-modifiable storage; (3) For the vegetable distribution process, formulate the vegetable safe distribution standard operating procedures.

3.2.3. Develop vegetable products under emergency conditions
Because of the epidemic, people are less likely to eat out, and more people choose to eat at home. The development of semi-finished dishes can respond to the changes of the current dining trend, which can not only meet the needs of consumers for nutrition and delicacy, but also meet the needs of consumers for convenient and quick cooking, providing consumers with new choices and providing new channels for the supply of vegetables under emergency conditions.

3.2.4. Establish the emergency vegetable quality assurance system
Establish an emergency vegetable quality assurance system as shown in Fig4.

3.2.5. Adjust the vegetable supply mode and establish the emergency vegetable allocation system
The epidemic has broken the traditional pattern of vegetable supply. In such a special period, it is necessary to study and adjust the pattern of vegetable supply in a timely manner, quickly establish an emergency vegetable distribution system, improve circulation efficiency, and increase the ability to resist risks.

3.2.5.1. Study on direct supply mode of origin
(1) Improve logistics efficiency, ensure the freshness of products, break through the supply and demand chain between producers and consumers, build the vegetable supply and demand information platform, and solve the problem of vegetable farmers "selling vegetables". (2) A visual monitoring system for security collection and distribution is embedded in the vegetable supply and demand information platform to facilitate consumers' understanding of vegetable collection information and distribution process[5]. (3) Set up external service functions of security and collection visual monitoring system. Users can scan two-dimensional code or direct Web link to get planting related information.

3.2.5.2. Research on processing and distribution mode
In order to increase vegetable reserves and relieve the overstock of vegetable farmers, enterprises process raw vegetables into clean vegetables, fresh cut vegetables, semi-finished dishes and other products, and carry out direct online supply through the vegetable supply and demand information platform, wechat business, e-commerce and other ways.

Research and development on the access mode of sensors and cameras used by enterprises.
4. Discussion
In recent 10 years, the storage and preservation technologies of vegetables at home and abroad have developed rapidly, such as air-regulated preservation technology, preservative preservation technology, biological enzyme preservation technology, ozone preservation technology, refrigerated preservation technology and irradiation preservation technology, which have been used to preserve vegetables, greatly extending the preservation period of vegetables. Compared with the developed countries in Europe and The United States, there is still a big gap in the storage and preservation of vegetables in China. For example, the postharpage loss rate of fruits and vegetables in China is as high as 25%-30%, leading to great waste, while in the United States, it is only 17%-5.0%. The main cause of this result is our country's devotion to postharvest is far from enough, developed countries have long put postharvest preservation processing in agriculture in the first place, such as the agriculture after mining before the mining investment ratio of 30% and 70%, Italy, the Netherlands, the industrialization of agricultural preservation rate was 60%, more than 70% in Japan, and far lower than the proportion of our country.

In order to stabilize the quality of vegetable products and ensure product safety, it is necessary to conduct in-depth research on the preservation technology, so as to maintain high freshness of vegetables in the process from producing area to table, and reduce the large area of waste caused by rot in the process from harvest to sale of vegetables.

5. Conclusion
The discussion and demonstration of the safe supply and distribution mode of vegetables under emergency conditions conducted in this study is conducive to the implementation of the "vegetable basket" product stable supply and the requirements of guarantee price, quality, and supply. It can overcome difficulties and make every effort to ensure the market supply of "vegetable basket" products opens up the entire chain of distribution links from the field to the table, and uses a variety of methods such as base direct supply mode and e-commerce platform to solve the problem of difficulty for citizens to buy vegetables and difficulty for farmers to sell vegetables. It is of great significance to meet the needs of citizens, guarantee the income of farmers, and maintain social stability.

Acknowledgement
Beijing Science and Technology Plan "Development and Brand Building of Functional Fresh-cut Vegetable Products " (Z181100009318001).

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