

## Research Article

### Food Safety Countermeasures Research Based on the Food Supply Chain

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**Abstract:** The food supply chain consists of some main parts, those are agricultural producer, food processor, wholesale and retail business, logistics distribution enterprise and the food supply chain involves some networks which are food processing, food transportation, food distribution and food sales. Based on the perspective of supply chain, proceeding from the five levels of production link, processing link, transportation link, storage link, and information link, after the investigation and analysis of problems in every part of food safety, this article proposes to improve the food safety laws and regulations system, to perfect the standard system of food supply chain, to strengthen the comprehensive management of food supply chain, to establish the credit system of food supply enterprise, found countermeasures such as food supply chain information monitoring, information notification, publishing network system, to promote mutual cooperation among various members of the food supply chain, and to construct the food safety supply chain which is organically connected and can be traced to its source.

**Keywords:** Food safety, food supply chain, food supply enterprise

## INTRODUCTION

The food supply chain is made up of the links of the primary food producer and the links of getting to the customers, and it mainly includes the raw material supplier, food supplier, wholesaler, retailers and end customers etc. They jointly form the chain-like or net-like food chain system. The food chain is customer-oriented, and the customer demands and the benefits of the companies can be maximized through the reasonable transportation, the circulation of capital and information.

In the food supply chain, generally food needs to be passed down through the farmers, food processors, circulators, catering industries and finally to the customers (Lim *et al.*, 2016). Therefore, the food supply chain which largely relies on the natural environment has the features of short circulation period, many links, high requirements on transportation equipments and management, the great market uncertainty, strict requirements on quality and high risks etc. owing that the food supply chain crosses the first, second and third industry. It covers the various links in planting, breeding, production and processing, transportation and catering management, thus it is quite complicated to manage. The food quality and safety problems can be rather wide and influential (Honda *et al.*, 2015). Meanwhile the food supply chain has timeliness feature for food is easily perishable and metamorphic, moreover in the transportation link food requires high for the time, and therefore, food supply chain has the feature of

timeliness (Fox *et al.*, 2015). Different uncertain factors will also affect the food quality. Owing that the food is based on the farming products which will definitely be affected by the natural environment, farming chemicals, fertilizers, and top three industrial wastes and the human acts, thus it is very difficult to test the quality level of food in different links. As a result, the food supply chain is biochemical.

## MATERIALS AND METHODS

The safety risks of food supply chain include the potential risks hidden in different links of the food supply chain (Zhu, 2013a). We have divided the food supply chain into production link, processing link, transportation link, storage link and information link and correspondingly do researches and analyze the problems of each link (Wu *et al.*, 2015). According to the regulations of the food quality safety management, the food safety link of the food supply chain is divided. Based on the premise of guarantying the food quality and safety and from the perspective of food supply chain, the goals of managing the food safety risks are settled (Brambilla *et al.*, 2015). On the foundation of taking the features of food safety as the operational basis and by normalizing the supervision management system, creating the supervision management pattern, coordinating the supervision management information and other methods to wholly supervise and coordinate different links in the food supply chain, the goal is to

create a multi-layer supervision management and testing system so as to achieve the whole risk management, limit the food safety risks within the controllable scope and finally realize the food consuming safety.

## RESULTS

**The production link of the food supply chain:** Along with the changes of people's food consumption structure and optimization of nutrition awareness, daily food, vegetables, fruit and other consumption goods can't meet people's increasing demand for food, the application of pesticide, chemical fertilizer, hormones, antibiotics coincides with the time, in pursuit of production, people often use pesticides, fertilizers and other chemical means to achieve the purpose, at the same time, in different degree, the agricultural planting and breeding process are influenced and polluted by pesticides, fertilizers, the three wastes. After people eat contaminated agricultural products, food borne diseases may be increased. Therefore, in the source of food supply chain, the large use of chemical medicine, biological agents, etc, brings enormous hidden danger to food safety. Such chemical, biological food pollution is often found in the food chain through long-term accumulation, which challenges food safety assessment work (Uyttendaele *et al.*, 2015).

**The processing link of the food supply chain:** Because the scales of food production enterprises in China are too small, the management is more muddled, and the food supply chain is very difficult to guarantee the food safety. Take wheat flour, rice, soy sauce, vinegar for instance, the products accounted for more than 40% of the total sales are produced by less than 10 people, in poorly equipped family-based enterprises. In the pursuit of maximum profit, manufacturers often neglect the input of equipment, facilities and management, in addition, management is lax and production control is not strict, the producing processing part is susceptible to microbial contamination. As a result, the speed of the product corruption in the process of storage and transportation is quickened. In order to improve food appearance and to extend the shelf life, in the processing part of food supply chain, the producers often need to add the appropriate amount of additives, but for the sake of economic benefits, a small number of enterprises, ignore food safety, excessively use or abuse food additives, and even use industrial auxiliary, additionally, most food enterprises do not have standard inspection ability, as a consequence, the food safety cannot be guaranteed.

**The transportation link of the food supply chain:** At present, most agricultural products in China still are directly sold in the farm product market, in the unprocessed or initial processed form. The majority of

the food business enterprise which adopts those ways of circulation, based on the cost consideration, do not use standard packaging, storage and transportation mode, and even in the food purchase, storage and transportation processes, there are situations of excessive use of preservatives and antistaling agents, as a result, management of tracing to the source is difficult, the food labeling is not standard, food grade packaging is low, it is necessary to strengthen the supervision of the circulation part of corresponding food supply chain of food safety, to avoid the circulation of fake and deteriorating food in the market.

The transportation of food supply chain includes transportation means, transportation ways, road infrastructure, transportation line and cold chain refrigeration, etc. Because the road traffic statuses in different regions have great difference, the road construction levels are uneven, food raw material place of origin, processing place and consumption place are different, there are differences in time and space, the requirement of the effective cohesion time of the transportation part in food supply chain is higher. The lack of refrigeration equipment may cause the damage of transport food, increase the operating cost of supply chain, lack of quantity or quality of transportation tool will lead to a long haul circle and low transportation efficiency, due to the short cycle of the food storage and transportation of most food, the transportation tool will have a direct impact on food transportation and food supply. Additionally raw materials needed for food production are more, the transaction object of core production enterprises shows an availability of multiple suppliers, most of the time, the supply groups are small-scale farmers, small-scale farmers' layout is more scattered, lack of professional ability to sell, the companies usually need to purchase to the doors of the small-scale farmers, which is bound to cause the mutual exchange time of the raw material procurement and transportation part increases, to the disadvantage of food transportation and preservation. These factors will lead to the delay or suspension of the transportation and distribution of raw materials, semi-manufacturers, and manufactured goods, resulting in the occurrence of problems in food supply chain.

**The storage part of the food supply chain:** The significance of inventory is to help companies to avoid or reduce the occurrence of suspension of work for lack of materials and suspension of business for lack of goods. If the enterprise can purchase the necessary raw materials in time, or can obtain the required goods in time in production process, under the circumstances, the enterprise needs no inventory, but this is the pure ideal state, in the market economy environment it does not exist. Therefore, by reason of external uncertainties, the inventory prices or quantity are changed, it is necessary for enterprises to buy raw materials at the bottom of the price and sell goods when the prices are

high. The inventory risk problem that the enterprises are faced with in the storage part of food supply chain is higher than that of other industries, because the inventory needs to occupy funds, space, labor power and other resources, if too much inventory occurs, overstocking is easy to be caused, funds are occupied, the operation cost of the enterprise is increased. On the contrary, inventory if too small is easy to cause shortage of goods, with serious impact on production, and loss of sales opportunities.

**The information link of the food supply chain:** With the change of modern lifestyle, the food consumption appears trends of diversity and changing, non seasonal food consumption and outside dining consumption activities increase, food consumption ascends. Massive food safety problems are more and more serious, food safety is undergoing changing processes, from the color, smell and other visible factors to the detection of pathogenic bacteria or pesticide residues by means of testing tool which cannot be quickly detected under the existing technology conditions. Food products which are detected before and after being produced is restricted by the related knowledge of the consumers. Since the consumers are away from the processes of the food production and circulation, the asymmetric effect of food safety information occurs, it is difficult to evaluate the food before eating, and people cannot rely on their own strength to effectively protect themselves. If we cannot guarantee that the food safety information is quickly and effectively passed on to consumers. If the situation that producers and operators deliberately conceal adverse information appears, the consumer's food safety problems will never be resolved.

## DISCUSSION

**Strengthen the national related laws and regulations system and improve the effectiveness of implementing the laws and regulations:** As for the food safety, the corresponding laws and regulations together with its management level in china lag behind many other countries in the world. China needs to build up a comprehensive food safety law system which is more scientific, reasonable and effective than the current one; however, it means that a lot of difficulties need to be overcome in this improvement process. At present, china has already set up the food hygiene law of People's Republic of china, the standard law of People's Republic of china, the product quality law of People's Republic of china and other related laws on food safety (Kirezueva *et al.*, 2015). Besides the state council has also established the regulations on farm chemicals, the regulations on veterinary drug, regulations on pig slaughtering and other related administrative laws and regulations. By establishing the regulations of related food department, china has established the basic law

framework and system to perfect the food laws and regulations.

Although different department have already spare efforts to improve or perfect the current food safety laws and regulations, there still remains some system vacancies and overlapped content problems in the current food safety laws and regulations. For instance, the farm law has stipulated the industries in plating, stock farming, fishery and other industries and their corresponding services prior to production, in production and after production. However, there are no special laws to adjust or deal with the food safety problems occurred in the links of planting, stock farming and other industries. For instance, the food hygiene law regulates the activities in production, collecting, purchasing, processing, storage, transportation, exhibition, supply, selling, etc. The product quality law regulates the activities like in producing and selling food which is produced or processed etc (Zhu, 2013b). The overlapped content of the laws and regulations, the overlapped scope of regulations, and the different levels of punishments in different laws and regulations towards a same problem are waiting to be settled. It is necessary to stipulate the food safety management relationship of the food companies by amending the current food hygiene law or building up a new food safety law based on the principle that the food companies should bear the primary responsibilities towards food safety. It is also necessary to figuring out the management problems existing in the food companies and the food safety supervision agencies and the ultimate goal is to improve the supervision power on food quality.

**Perfect the standard system of the food supply chain:** There is a big gap between the current Chinese food standard system and the international food standard system, which is mainly displayed by the problems of relatively less advanced technologies, the shortage of the testing standards, and moreover most of the standards are put forward by different departments thus many standards are contradictory with each other. Owing that the food supervision in china mainly adopts the segmented management pattern and the historical problems of different food industry standards established by different departments in china, thus there are some contradictory problems in each food standard. Setting up a unified, authoritative food safety standard system to solve the problems of the overlapped and contradictory food industry standards of the current laws and regulations, improve the level of food standard techniques, and offer reliable technological data for food safety work should begin with amending the current food standard system and establishing the food standard system from six aspects, namely the standard of the processed food and the subsidiary agricultural products, the basis of food industry and its related standards, the standard of food inspecting method, the hygiene

standard of food processing production, the standard of food package material and container, the food additive standard (Pagadala *et al.*, 2015). It is also very important to clear up the standard of food product and hygiene related to the food safety, rectify the shortcomings of the current food safety standards, and speed up the establishment of the food safety standard system. At the same time, to enhance the advertising of related standards, guide the food companies to organize production strictly according to the standards, and guide customers to select and but the products which match the safety standards cannot be neglected.

**Strengthen the comprehensive management of the food supply chain:** Strengthen the source controlling and guaranty the food safety and food quality from the beginning. It can be achieved by enhancing the environment protection of the production place and normalize the usage of chemical fertilizers, farm chemicals, veterinary drugs, feed additives, set up a sound environment supervision network of the food production place, make sure the food production environment is in accordance with the requirements of safety production, and promote the development of organic food and green food; strengthen the management of production process and make sure the raw material, processing production links conform to the requirement of the food safety. Forbid the behavior of cutting labor and material, replacement of the good products with the bad ones, adoption of the substitutes etc and strictly operate the production process according to the requirements, enhance the supervision of the key links in production, carry out the products tests strictly, test the raw materials, semi-products, final products, and deal with the problems timely to make sure the food safety.

In some industries to compulsorily implement the analysis of the dangers in food production companies, the production management of the key controlling points and the self-management pattern of the good manufacturing practice and to establish and perfect the market access system and strengthen the test of the farming products waiting to be marketing (Surak, 2015). Prevent the unsafe farming products' access into the market or into the raw material of the foods, and establish a sound food market access system and the testing standards and methods of the food. To actively connect to the international market by carrying out logo management, advocating the marketing system of the foods package grading and logo system to show the producing place. The producing place and producer must be listed on the package of the farming products. The logo or label of genetically modified organisms needs to be stipulated and a traceable system needs to be established within a certain scope.

**Establish the credit system of food chain supply companies:** Establish and perfect the credit system of food chain supply companies and strengthen the food

companies' self-discipline and honest management (Zhu, 2013c). Only when the food suppliers, producers and sellers on this food chain can operate their duties according to the standards, honestly do business, be strict with them, and then the food safety in the whole society can be developed in a positive cycle. Food safety is the root of the development of food companies, thus it is understandable to strengthen the self-discipline mechanism of the food company. A food company can only be developed well by implementing the safety promise of producing food, guarantying the source process, maintaining the traceable process system and recalling back system of the problem products and a good food company need to apply the international circulated products quality management and the quality controlling methods, and make sure the whole food making process such as the process of food processing, storing, selling etc conform to the related standards and requirements of related technological regulations. Meanwhile, food companies should be encouraged to take part in the product certification system and bring in the management system certification, and further to pass the certifications of HACCP, ISO9001, ISO14000 and ISO22000 system.

**Establish the network system to supervise, notify, and post the general information of the food supply chain:** The government needs to set up an effective announcing system of the food safety information. In the file of the Chinese state council's decision on further promote the food safety work; it has stressed the fast establishment of the food safety informationization and the management and the comprehensive application of the food safety information (Chen *et al.*, 2015). One important thing is to take the establishment of the effective information as the important method of the food supply chain's safety management, which can regularly post the information of food production and the whole circulation testing process to the mass public as well as offer services for both the food customers and suppliers (Brambilla and Testa, 2014). To set up a comprehensive network system which has integrated the functions of supervising, advertising and posting the safety information of the food supply chain is to achieve the goal of sharing data and information from each department; a well circulated network system of information supervision and advertising is beneficial for forming a united, scientific indicator system to estimate the safety information and analyze the food safety management risks and precast the food problems and also is beneficial to analyze the food safety status timely (Fernández-Segovia *et al.*, 2014).

It is necessary to widely apply the food safety information system and the code technology together with the management of food safety and food traceable process (Wertheim-Heck *et al.*, 2015). The management system of the food safety information system adopts the GPS, the geography information system and the wireless RF identity technology as the main supportive technology to trace and track the food and realize the

reliable identification and information transmission of the whole food production process including production, processing, package, circulation, storage, and selling (Sawe *et al.*, 2014).

### CONCLUSION

The food supply chain is made up of the links of the primary food producer and the links of getting to the customers, and it mainly includes the raw material supplier, food supplier, wholesaler, retailers and end customers etc. They jointly form the chain-like or net-like food chain system. The food chain is customer-oriented, and the customer demands and the benefits of the companies can be maximized through the reasonable transportation, the circulation of capital and information.

In order to control the risk of food quality and safety in the controllable range, through enhancing the protection over production environment and regulation of the use of chemical fertilizers, pesticides, feed additives. We should improve food production management at the source, and ensure production environment in accordance with the requirements of safety in production; by improving the food market access system and completely eradicating the phenomenon of manufacturing and selling of fake and inferior food. We can prevent unsafe food into the market and being used as food raw materials, we can ensure the healthy development of the food industry and social stability and security. The whole process of food safety is a kind of process in which related interest bodies contest in every part of the food supply chain, only if every member among the food supply chain collaborates with each other, then we can establish scientific and safe food supply chain system, and we can ensure the quality of technology, raw materials, processing operations, storage, transportation and other related aspects, ensure the safety of related products, and ultimately gain quality under safety, promote development by quality.

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