

Social Research on Food Safety and Vendor Management based on Big Data Analysis: Take Tianjin Street Food Management as an Example

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Abstract: The street-trafficking economy has played a huge role in Chinese cities, especially after the epidemic. However, concerns about street vendors' hygiene and crowded working conditions may affect consumers' purchases of street food. This study investigated the food safety knowledge of 111 consumers and the expectations of street vendors. The author also observed the food handling behavior of 100 street vendors in an automatic vending area designated by the Xiqing District of Tianjin, a first-tier city in China. The author analyzes and discusses the collected data through big data analysis. The study found that street vendors meet most of the consumers' expectations in hand washing before operation, using clean utensils, separating cooked and raw meat, but they can still improve in mask wearing, gloves wearing, hair cover wearing, food storage in sealed containers and displaying licenses. The study shows that government regulations of demarcated vending zones, simplified formalization process, and public supervision can stimulate good food handling behaviors of street vendors. This study recommends the implementation of demarcated vending zones, simplified formalization process of street vendors, and encouragement of public supervision in other cities.

1 INTRODUCTION

The street vendors have played important roles in informal economy, social development, and cultural diversity. They not only relieve the pressure of employment, provide affordable goods, but also make the urban space more vibrant. The Covid-19 has caused unprecedented employment pressure in Chinese cities, the employed population growth in urban areas decreased to 2.29 million in 2020 from 3.24 million in 2019, with the service sector suffered the most, which sector accounted for 46.3% of the jobs nationwide (CMB International Securities 2020). The government has turned to street vending economy to offer job creation, promoting pro street vending policies led by Premier Li Keqiang since March 2020 in 27 major cities including Tianjin, Chengdu and Shanghai (CMB International Securities 2020). The pro street vending policy piloted in Chengdu and received immediate success, with 36,000 mobile vending stalls set and more than 100,000 jobs created in accordance with local regulation by May 2020 (Chengdu hi-tech industrial development zone 2020). With favorable policies,

street vending activities became a national trend that also received financial support from large corporations such as Alibaba and JD (Li, 2020).

While the street vending has become trendy in China, consumers might still hold concerns over the hygiene, food safety, and working conditions of street vendors, which might stop them from buying street food. This research distinguishes two main types of street vendors. The first is mobile street vendors, who carry carts, bicycles, or vehicles that can move on the street for business activities. The other type is fixed booth vendors, who operate in fixed booths and can stay on site at the end of the working day. While there are specific regulations regarding mobile street vendors and fixed stall street vendors, fixed stall vendors are usually more formalized and are required to pay rents and legal licenses. This study is most interested in the food handling practices of fixed stall street vendors operating in demarcated vending zones of Tianjin. To understand the public expectations from street vendors and give recommendations on improvement of street vending activities, this research conducts two questionnaires to collect responses from 111 consumers' food safety

knowledge and their expectations from street vendors, then designed a food safety practice checklist completed based on the researcher's observation of 100 fixed stall street vendors operating in the demarcated vending zones in Xiqing district of Tianjin, China.

2 LITERATURE REVIEW

The history of Chinese street vendors can trace back to more than 2000 years, one of the earliest evidences of street vendors can be found in the historic texts of the Rites of Zhou from the 2nd century BC, which cites "morning markets were filled with traders; evening markets were willed with vendors consisting of husbands and wives". Since the founding of the People's Republic of China in 1949, however, the development of Chinese street vending economy has been largely influenced by national politics. Street vending activities were strictly prohibited until 1978, when the Chinese economic reform facilitated the return of street stall economy (Song 2020). Yet, from 1990 to 2019, street vending activities became an obstacle to preserving the city's image, leading to exclusionary policies towards the street vendors, such as the "National Sanitary City campaign" (Xue & Li 2014).

The food safety aspect of street vending activities has always been a hot topic in China and internationally. It is estimated that about 70% of the food-borne disease outbreak is associated with food made outside home (Chapman, Eversley, Fillion, 2010). Shen of Anhui university (Shen 2020) acknowledges the street-stall economy's ability to stimulate the economy by easing unemployment but shows concerns about the issue of food safety and after-sales service of street vendors. Song of East China University (Song 2020) argues that there has long been a gap between the food safety requirement and street vendors' knowledge due to the vendors' low level of education and lack of ways for knowledge sharing on food safety. It is indicated by both Shen and Song that many street vendors are reluctant to sacrifice personal profits to ensure food safety, even in the face of governmental regulations. While Shen expresses worries about the chances of reinfection of Covid-19 from the often-congested working conditions of street vendors, a report by CMB (CMB International Securities 2020) international argues that the open-air conditions of the street stalls could decrease the risk of reoccurrence of the pandemic.

Previous studies on informal street vending food safety in Bangladesh and China have found undesirable results. Kundu et. al. (Kundu, Banna, Sayeed 2021) in their research in 2020 found that the overall hygiene practices of street vendors in Barishal and Patuakhali, Bangladesh were unsatisfactory, especially among the vending stalls without extra employees. Another research article by Ma et. al. (Ma, Chen, Yan, 2019) in 2019 assessed food safety knowledge, attitudes of street vendors and consumers using questionnaires, and assessed street vendors' behaviors by observation in Handan, a third-tier city in China. Ma et. al. found that street vendors had generally poor food handling practices, with older consumers having worse food safety attitudes than younger consumers. Kundu et. al. and Ma et. al. agree that food safety training or education of street vendors would boost the hygienic standards of street vending stalls.

3 METHODOLOGY

Sampling was done at 100 street vendors operating in street stalls in the demarcated vending zones of Xiqing district, Tianjin. The sample were collected between 19:00 and 23:00, which is the legal hour for street vending activities. Two questionnaires each of 10 questions are designed to record 111 consumers' food safety knowledge and expectations from street vendors. A food safety practice checklist of 16 items is completed based on the researcher's observations of 100 street vendors operating in the demarcated vending zones in Xiqing district of Tianjin, China.

4 RESULTS AND ANALYSIS



Figure 1: Guests are order food.

Table1: Consumers' food safety knowledge.

| | Question | True | False | Do not know |
|----|---|-------------|------------|-------------|
| 1 | Food-borne diseases can cause abortions in pregnant women | 78 (70.27) | 3 (2.70) | 30 (27.03) |
| 2 | Coronavirus can be transmitted by food | 90 (81.08) | 11 (9.91) | 10 (9.01) |
| 3 | AIV (Avian Influenza Virus) can be transmitted by food | 91 (81.98) | 9 (8.11) | 11 (9.91) |
| 4 | AIDS can be transmitted by food | 26 (23.42) | 73 (65.77) | 12 (10.81) |
| 5 | Reheating the food can lead to food contamination | 61 (54.95) | 26 (23.42) | 24 (21.62) |
| 6 | Microbes are in the skin, nose, and mouth of health people | 106 (95.5) | 2 (1.80) | 3 (2.70) |
| 7 | Bloody diarrhea can be transmitted by food | 96 (86.49) | 2 (1.80) | 13 (11.71) |
| 8 | Washing the eggshell can prevent food-borne diseases | 43 (38.74) | 48 (43.24) | 20 (18.02) |
| 9 | Checking the temperature of fridge periodically can reduce the risk of food contamination | 87 (78.38) | 12 (10.81) | 12 (10.81) |
| 10 | Swollen cans might contain bacteria | 101 (90.99) | 2 (1.80) | 8 (7.21) |

Table 2: Consumers' expectations from street vendors.

| | Expectation | Yes | No | Do not care |
|----|---|-------------|-----------|-------------|
| 1 | Street vendors should ensure they are healthy before work | 109 (98.20) | 1 (0.90) | 1 (0.90) |
| 2 | Street vendors should wash hands before operation | 101(90.99) | 7 (6.31) | 3 (2.70) |
| 3 | Street vendors should wear masks to prevent the spread of food-borne diseases | 102 (91.89) | 5 (4.50) | 4 (3.60) |
| 4 | Street vendors should wear gloves to prevent food contamination | 109 (98.20) | 1 (0.90) | 1 (0.90) |
| 5 | Street vendors should wear hair covers to prevent food contamination | 106 (95.50) | 3 (2.70) | 2 (1.80) |
| 6 | Street vendors should store cooked and raw food separately to prevent food contamination | 105(94.59) | 4 (3.60) | 2 (1.80) |
| 7 | Street vendors should separate food and washing products to prevent food contamination | 100 (90.09) | 5 (4.50) | 6(5.41) |
| 8 | Street vendors should use detergent to wash dishes to prevent food contamination | 95 (85.59) | 11 (9.91) | 5 (4.50) |
| 9 | Street vendors should clean dish towels frequently to prevent food contamination | 106 (95.50) | 1 (0.90) | 4 (3.60) |
| 10 | Street vendors should sanitize knives and cutting boards periodically to prevent food contamination | 105 (94.59) | 4 (3.60) | 2(1.80) |

Table 1 demonstrates that the consumers have generally good knowledge of food safety with exception of question 2 and question 8 that more than half of all respondents wrongly believed or were unsure of. While most respondents correctly understood that avian influenza virus (81.98%) and bloody diarrhea (86.49%) can be transmitted by food, a striking 81.08% of respondents wrongly believed that coronavirus can be transmitted by food. Furthermore, almost all (90.99%) of respondents correctly believed that swollen cans might contain bacteria, and 78.38% respondents correctly believed that checking the temperature of fridge periodically can reduce the risk of food contamination. Moreover, most (70.27%) respondents correctly believed that food-borne diseases can cause abortions in pregnant women, but 27.03% of them are unsure of that fact.

Furthermore, almost half (43.24%) of all consumers wrongly believed that washing the eggshell can prevent food-borne diseases, and 23.42% of consumers wrongly believed that AIDS can be transmitted by food. Lastly, 23.42% of consumers wrongly believed and 21.62% of consumers did not know that reheating the food can lead to food contamination. Table 2 depicts the consumers' expectations from street vendors. Most respondents expect the street vendors to be healthy to work (98.20%), wash hands before operation (90.99), wear masks (91.89), wear gloves (98.20), wear hair covers (95.50), store cooked and raw food separately (94.59), separate food and washing products (90.09), use detergent to wash dishes (85.59), clean dish towels frequently (95.50), and sanitize knives and cutting boards periodically (94.59)

Table 3: Observed food handling behavior of street vendors in demarcated vending zones of Xiqing district, Tianjin.

| | Observed item | Yes | No |
|----|--|-----------|---------|
| 1 | Vendor has an unexpired license | 46 (46) | 54 (54) |
| 2 | Vendor wears a mask | 32 (32) | 68 (68) |
| 3 | Vendor wears gloves | 18 (18) | 82 (82) |
| 4 | Vendor wears a hair cover | 22 (22) | 78 (78) |
| 5 | Vendor wears clean clothes, apron | 94 (94) | 6 (6) |
| 6 | Food stored/displayed in sealed containers | 35 (35) | 65 (65) |
| 7 | Raw and cooked food are kept separate | 100 (100) | 0 (0) |
| 8 | Single use utensils are utilized | 91 (91) | 9 (9) |
| 9 | Utensils are cleaned and covered | 89 (89) | 11 (11) |
| 10 | Site is far from trash cans | 47 (47) | 53 (53) |
| 11 | Site is far from sewer and wastewater | 90 (90) | 10 (10) |
| 12 | Site is far from animals | 87 (87) | 13 (13) |
| 13 | Site is far from toilet facilities | 98 (98) | 2 (2) |
| 14 | No flies on the site | 92 (92) | 8 (8) |
| 15 | No stink smell | 98 (98) | 2 (2) |
| 16 | Recent 10 transactions made digitally | 100 (100) | 0 (0) |

Table 3 shows the food handling behavior of 100 street vendors in a demarcated vending zone in Xiqing district, Tianjin. All (100%) street vendors accepted electronic payment, and the recent 10 transactions as observed by research were made digitally. Almost half (46%) of street vendors have an unexpired license displayed on site. Although most (94%) vendors wore clean clothes and aprons, 68% of vendors did not wear a mask, 78% of vendors did not wear any sort of hair cover or hat, and 82% of street vendors used bare hands during food handling. While all street vendors appeared to have keep the uncooked and cooked food separately, only 35% of street vendors stored food in sealed containers. About 91% of all street vendors used single-use utensils, but some (11%) vendors displayed the utensils in open air and as attraction to customers. Although most of the vendors were free from flies (92%) and stink smell (98%), 53% of street vendors operated within 2 meters of trash cans. 10% of street vendors appeared to have disposed wastewater behind their stalls. 13% of street vendors are close to pet animals for sale. Although the pet seller claims that these animals have been vaccinated, there is no evidence to support this. 2% of street vendors are near removeable toilet facilities, but the toilet facilities were sealed and clean.

In summary, consumers have a good understanding of food safety knowledge, and street vendors have reached most of the customer standards in terms of food safety. The street vending transactions observed by the author are all done through QR code payment, which means that the food

handler does not need to collect payment manually. The digital mode of transactions reduces the chances of infection while allowing the food handlers to wash hands less frequently. This type of transaction is also easier to meet consumers' expectations of street vendors washing their hands before operation (98.2%). All (100%) street vendors also did well in storing cooked and raw food separately. 91% of street vendors in this study used single utensils, while 11% of them did not cover the utensils. However, only 46% of street vendors displayed their operational licenses to indicate they are healthy to work. Furthermore, more than half of the street vendors in this study failed to meet the consumers' expectation of wearing a mask (68%), wearing gloves (82%), and wearing a hair cover (78%).

5 DISCUSSION

Compared to earlier studies of informal street vendors in in Barishal, Bangladesh and Handan, China, fixed stall street vendors in Tianjin have shown satisfactory food handling behaviors, meeting most of the consumers' expectations. This is the result of a combined effort of governmental regulations on demarcated vending zones, encouragement in public supervision, and the facilitation of formalization process of street vendors.

The authority prohibits outdoor commercial activities in demarcated vending zones except for fixed stall vendors, the vendors are also required to

follow rules regarding food types, emission of cooking fume, and utensils cleanness. If vendors do not comply with the rules after oral warnings they will be fined (Tianjin Municipal People's Government 2016). The demarcated vending zones are equipped with public facilities including clean running water in each stall, clean toilet facilities, tables, chairs, and trashcans to preserve the city's image. In 2019, the government of Xiqing district, Tianjin publicly announced to simplify formalization procedures, while ensuring the minimum procedures still require the operators' IDs, health certificates, description of proposed business and sanitary condition, and written guarantees for food safety responsibility (Aixiqing 2019). Furthermore, article 34 of "Tianjin municipality for supervision and administration of street vendors" states that agencies should organize free food safety training for street vendors (Tianjin Municipal People's Government 2016). The consumers are encouraged to participate in public supervision by dialing for customer complaints and they will be rewarded if the complaints are verified (Tianjin Municipal People's Government 2016). Hot-line numbers are displayed on the signs in demarcated vending zones.

While the overall food safety practice of street vending activities in demarcated vending zones appears satisfactory, there are spaces for improvement. One suggestion this study would like to make is to make sure fixed stall street vendors comply with the mask wearing, gloves wearing, and hair cover wearing, food storage in sealed containers and displaying licenses or other indications of healthy employees through stricter supervisions and penalties. Based on the researcher observation, though every food vending stall have hand washing facility, the site lacks apparent hand washing facilities for consumers. Therefore, this study suggests the implementation of more hand washing facilities for consumers. While the government clearly states that only fixed stall street vendors are allowed to operate in the demarcated vending zone, the researcher identified several informal vendors and sellers that neither operated under fixed stalls nor had legal licenses. The accumulated number of informal sellers can not only congest the streets, but also pose a risk on public safety. This study suggests that the administration to either make efforts to formalize them or to expel them.

6 CONCLUSION

The study concludes that government regulations of demarcated vending zones, public supervision, and facilitation in formalizing street vendors can stimulate the good food handling behaviors of street vendors. The consumers' expectation from fixed stall street vendors in this research are mostly met, with exceptions. The study suggests introducing stricter supervision and penalty to ensure the street vendors wear masks, gloves, and hair covers, storing food in sealed containers and displaying licenses or other indications of healthy employees. Furthermore, the study suggests the government should implement more hand washing facilities for consumers, as well as formalizing or expelling informal sellers in the demarcated vending zones to improve public health and preserve the city's image. At last, the study recommends the implementation of demarcated vending zones, encouragement in public supervision, and simplified formalization process of street vendors in other cities. In addition, since this study only investigated one area on the spot, the sample size and related data still have certain limitations. In future research, the author will use more qualitative and quantitative research methods and expand the sample size for in-depth research.

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