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Household food waste in rural China: A noteworthy reality and a systematic analysis

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Abstract

Economic development has improved people's daily diets in China, but food waste has increased significantly. China faces severe natural resource constraints, and reducing food waste is important for ensuring national food security. Based on 1634 survey samples from 28 provinces in China, this study assessed food waste in rural China and empirically analyzed the main factors affecting rural household food waste. The results showed that, on average, 1.67% of food is wasted per household each day in rural China. Food waste is greater in economically developed areas, such as East China. Empirical analysis showed that cooking utensils, preparing the right amount of food, religious beliefs, number of family members, average weight of family members, percentage of purchased grain in the total food consumption in 1 year, and total grain output are significantly related to rural household food waste.

Keywords

Food waste, food security, main determinants, fractional response model

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Introduction

Earth is currently experiencing a population boom (United Nations, 2019). At the beginning of the last century, the world population was 1.6 billion; today, the world population is close to 8 billion[1]. However, Earth's water and land resources are limited (D'Odorico et al., 2018). Currently, 55 countries and territories are in food crises, 183 million people are under stressful conditions, and living on the cusp of acute hunger, and 17 million children are suffering from acute malnutrition (World Food Programme, 2020).

The United Nations Environment Programme (2021) estimates that 931 million tons of food are wasted by households, restaurants, and retail stores, accounting for 17% of the total food available to consumers. Food waste is even more serious in developed or rapidly developing economies, and these countries should take greater responsibility for preventing food waste and contribute more to the world (FAO, 2019). Food waste in the United States is very serious, over one-third of all available food goes uneaten through loss or waste, and each year, the average American family of four loses $1500 to uneaten food (USDA, 2021). The amount of food waste in the EU reached 88 million tons per year, which is equivalent to 173 kilograms per person (Stenmarck et al., 2016). Food waste has become the largest portion of post-harvest loss (PHL) and waste in China, and 17–18 million tons of food are wasted in the catering industry alone in China annually (Xu et al., 2020).

To reduce food waste, it is critical to not only assess the level of food waste but also analyze the important factors causing the waste. Generally, the higher the household income, the more likely food waste is to occur (Yu and Jaenicke, 2020). Meanwhile, families generally prepare food based on the maximum number of people in the household, even if the number of people who eat at home varies; consequently, larger families have greater food waste (Parfitt et al., 2010; Sosna et al., 2019). Based on survey data from China, Min et al. (2020) found that improving household decision-makers' dietary knowledge could reduce food waste. Some food policies can also reduce household food waste. For example, food donation policies in Italy can reduce the number of people discarding food after the best-before date (Busetti, 2019).

Food waste has been discussed extensively in the literature with fruitful results, but these studies have a number of shortcomings. First, many conclusions are based on expert conjecture or second-hand data, and the few studies that have adopted field surveys have had small sample sizes (Minten et al., 2020). The accuracy and representativeness of the research results require further improvement (Bellemare et al., 2017). Second, most studies have focused on food waste in developed countries or food waste in the catering industry have given insufficient

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Table 1. Geographical distribution of samples.

Region	Province (municipalities and autonomous zones)	Observations
North China	Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia	210
Northeast China	Liaoning, Jilin, Heilongjiang	320
East China	Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong	317
South-central China	Henan, Hubei, Hunan, Guangdong, Guangxi	302
Southwest China	Sichuan, Chongqing, Yunnan, Guizhou	167
Northwest China	Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang	318
Total		1634

attention to rural household food waste (e.g. Liu and Chen, 2020; Xu et al., 2020). Hence, previous results on food waste may be unreliable. Third, most studies have only measured and evaluated the amount of food waste and have not conducted in-depth explorations of the causes of food waste (e.g. Liu et al., 2013; Ribeiro et al., 2019).

We make the following contributions to research on food waste. First, we used a large-scale survey to obtain first-hand data on food waste. These data come from 28 provinces in China, and more than 1600 rural households participated in the survey. Large-scale and large-sample data allow us to accurately understand the current situation of food waste in rural China.

Second, we focus on Chinese rural households' food waste, for which only very limited information exists. China's rural areas have undergone earth-shaking changes (Ma et al., 2020). Farmers' consumption structure has changed greatly, and the consumption of meat, eggs, milk, and other high-quality foods has increased rapidly (Sheng and Song, 2019). The experience of developed countries shows that food waste increases with income increase (Hodges et al., 2011). However, we do not know enough about the present state of food waste in rural China under the current economic development. A detailed understanding of food waste by Chinese rural households is a prerequisite for introducing relevant food policies.

Third, we not only evaluated the amount and level of food waste of Chinese farmers but also build econometric models to analyze the factors that affect food waste. Previous studies have either stayed at the level of measuring the amount of food waste or only focused on the impact of income level and other family characteristics on food waste. Further deepening of related studies is required. In this article, we focus on the effects of cooking utensils, fuel, and eating habits on household food waste.

Materials and methods

Data collection

From June to July 2016, we cooperated with the Rural Fixed Observatory Point Office (RFOPO) to carry out a nationwide survey on PHL and waste in China. We designed the questionnaires, and professional investigators from the RFOPO performed the household investigation. The rural fixed observation point system was established in 1984. The system uses scientific statistics to select 23,000 sample farmers distributed in 31 provinces (municipalities and autonomous zones) across the country (except Hong Kong, Macao, and Taiwan). The farmers in this survey are all from the sample database of fixed observation points, and our survey covered 28 provinces (municipalities and autonomous zones).

Sample households were selected as follows. First, we divided China into six regions based on geographic location, eating habits, and economic development. Second, in each region, we distributed survey samples according to the population of each province, that is, provinces with greater populations had more samples. Third, in each province, we randomly selected two counties; in these two counties, we also randomly selected two (or more) villages. Fourth, in each village, we randomly selected the survey households. Finally, the selected rural households conducted a book-entry survey for three consecutive days. They calculated each meal's waste by recording the weight of the food before and after consumption.

In this survey, we divided food into eight categories according to price, type, and frequency of consumption; farmers weighed them separately. These categories include staple food (flour products and rice products), potatoes, soybeans, pork, beef and mutton, poultry, aquatic products, and eggs. The survey also provided information about family cooking behavior, food handling behaviour, and other information. We obtained 1634 valid samples in total (Table 1).

Methodology and empirical strategy

The principles of consumer theory can be used to construct a theoretical framework of household food waste (Richards and Hamilton, 2018). A household food waste model has also been established based on household production theory in previous literature (Min et al., 2020). The forms and variables of the models built on these two theories are essentially the same. We combined these two theories and assumed that farmers can obtain foods through both production and the market:

$$F_i = \sum_{n=1}^{N} Q_n - C_i l \tag{1}$$

where F_i represents household *i's* produced or purchased amount of foods; Q_n represents the amount or quantity of food from food product *n*; $C_i l$ represents the cost where *l* is a scalar, denoting the labor input of household food production or purchasing; and C_i is the corresponding cost for food F_i.

Hence, from the waste or loss perspective, food loss is defined by $C_i l$. Obviously, household cost C_i depends on the food availability of Q_n, food processing methods such as cooking practices, and household decision-maker characteristics.

Equation (1) can be rewritten in a matrix form:

$$F = Q - lC \tag{2}$$

Here, lC represents food loss which can revert back to food Q^L. This formula shows the quantity of household food waste in a production or purchasing framework, which we can assume is the household food cost. We measured food waste by the food waste rate for each product:

$$FWR_n = Q_n^L / Q \tag{3}$$

Equation (3) is the measurement method for the food waste rate for food product *n*. In other words, it is the proportion of food waste for food product *n* in total food consumption.

As mentioned above, household food waste in equation (1) depends on the food availability of Q_n, food processing methods such as cooking practices, and household decision-maker characteristics.

Food availability is related to local supply, local economic, and other regional characteristics. We use local dummy variables and distance to the nearest town as display variables for food availability.

Previous studies have included factors related to food waste such as family characteristics and household socioeconomic variables (Di Talia et al., 2019; Florkowski et al., 2018; Yu and Jaenicke, 2020). In this study, we also considered cooking practices, taste preferences, and grain production. Hence, we established the following model:

$$\begin{aligned} y_i = \alpha_0 + \alpha_1 cp_i + tp_i + household_i \\ + social_i + local_i + \varepsilon_i \end{aligned} \tag{4}$$

where y_i is the food waste of household *i*, a fraction ranging from 0 to 1, inclusive; cp_i is the cooking practices of household *i*, including the utensils farmers use to process food, the fuel type used by the household, the method for or attitude toward food processing, and food storage facilities; tp_i is the taste preference of household *i*; $household_i$ represents the characteristics of decision-makers or other household variables; $social_i$ represents the characteristics of the socioeconomic level of household *i*; and $local_i$ is the location dummy variable of household *i*.

Because of the outcome variable is a fraction with a value of 0 to 1, inclusive. Linear estimation methods such as ordinary least squares may not be suitable for estimating such dependent variables (Chegere, 2018). Papke and Wooldridge (1996) suggested using the fractional response model (FRM) to handle outcome variables as a fraction. The model synthesizes and extends the generalized linear model and the quasi-likelihood method. The characteristics of this model can overcome most limitations found in other traditional econometric models for fraction-dependent variables. This model can also produce a better fit than the linear estimation model. Hence, following the recommendations from Papke and Wooldridge (1996) for this regression analysis, logit quasi maximum likelihood estimation was used to estimate the FRM.

Descriptive statistics

Table 2 shows descriptive statistics for the farmer-reported data collected during the survey. We categorized the variables into four types: cooking practices, taste preference, decision-maker and household characteristics, and socioeconomic variables.

On average, each Chinese rural household wastes 1.67% of total food consumption per day, but there is huge variation in food waste among rural households. Some rural households did not report any waste, whereas other households experienced serious waste of up to 41.85% of total food.

We used multiple variables to obtain information about rural households' cooking practices in this study. First, we obtained information on the utensils that farmers use to process staple foods. We divided the utensils into two types. One type is the traditional iron pan, which has different capacities. Farmers generally choose the size that meets their needs. The other type of utensil includes modern cookers. Compared with traditional iron pans, modern cookers are easy to operate and save time. Their capacities are standardized, and the capacity that farmers generally used was approximately 4 liters. In our sample, more than half of households (54%) use modern cookers to process staple foods.

Second, we investigated the stir-frying tools of rural households. We also divided these tools into two types: traditional iron woks and modern woks. The major difference between these two woks is capacity. The capacity of a traditional wok is much larger than that of a modern wok. Sixty-four percent of total households currently use a modern wok for stir-frying.

Third, we investigated the main fuel farmers used for cooking. In the past, most Chinese farmers used wood fires for cooking. Now, with improvements in infrastructure, 71% of the households in our sample use gas or electricity for cooking.

Fourth, we asked the farmers how they deal with leftover ingredients. Seven percent of households have a habit of directly discarding unprocessed ingredients[2]. Seventy-six percent of households prepare the correct amount of food and do not deliberately cook more food[3]. In addition, in most families, women are responsible for cooking, and 91% of households have refrigerators.

Taste preference determines the food processing methods. In our study, taste preference includes two variables: whether chicken essence is added during cooking and whether households enjoy spicy food. Seventy-six percent of households cook with monosodium glutamate or chicken essence, and 56% of households prefer spicy foods.

A total of 81% of household decision-makers are male. The average age and years of education of decision-makers are 53.90 and 7.29, respectively. Four percent of the households have religious beliefs. The average number of residents per household (people who are at home for more than 180 days per year) is 3.89.

Table 2. Descriptive statistics of the main variables.

Variable	Obs.	Mean	SD	Min	Max
Food waste (as a proportion of total consumption)	1634	1.67	2.78	0	41.85
Cooking practices					
Staple food utensils: using a modern cooker such as a pressure cooker or an electric cooker (yes = 1)	1634	0.54	0.50	0	1
Using a modern wok for stir-frying (yes = 1)	1626	0.64	0.48	0	1
Using gas or electricity (yes = 1)	1626	0.71	0.45	0	1
Discarding food without processing (yes = 1)	1634	0.07	0.25	0	1
Preparing the correct amount of food (yes = 1)	1625	0.76	0.43	0	1
Who is usually responsible for cooking? (husband = 1)	1625	0.08	0.28	0	1
Refrigerator (yes = 1)	1634	0.91	0.29	0	1
Taste preference					
Cooking with monosodium glutamate (MSG) or chicken essence (yes = 1)	1626	0.76	0.43	0	1
Preferring spicy food (yes = 1)	1625	0.56	0.50	0	1
Decision-maker and household characteristics					
Sex of the decision-maker (male = 1)	1634	0.81	0.39	0	1
Age of the decision-maker (years)	1634	53.90	10.59	21	89
Years of schooling of the decision-maker	1634	7.29	2.60	0	16
Religious beliefs (yes = 1)	1634	0.04	0.21	0	1
Number of residents in household (at home for more than 180 days per year)	1634	3.89	1.75	0	23
Average age of the family members	1618	46.07	12.77	16.83	90
Average weight of the family members (kg)	1618	59.33	7.63	31.5	92
Socioeconomic variables					
Distance to the nearest town (km)	1634	4.96	4.96	0	50
Annual income (yuan[a])	1631	63,025.82	57,493.77	2090	727,670
Percentage of purchased grain among total consumption in 1 year	1634	0.31	0.40	0	1
Total grain output (tonne)	1634	5.98	9.72	0.06	136.20

[a]Yuan is the Chinese currency unit, 1 USD = 6.55 yuan (December 23, 2020); Farmers who did not report data for all variables were excluded from the empirical analysis.

In addition, the average age and weight of the family members are 46.07 years old and 59.33 kg, respectively.

On average, the distance to the nearest town is 4.96 km, and the annual income is 63,025.82 yuan (worth 9636.98 USD). In contrast to urban residents, most farmers guarantee their family's grain consumption through self-production and storage. We used the percentage of grain purchased to represent the grain consumption of rural households. On average, 31% of grain is purchased from a market, and the total grain output per year is 5.98 tons per household.

Results

Household food waste in rural China

Table 3 shows the overall situation of household food waste in rural China. On average, 1.67% of food is wasted each day. If we convert this number into grain, each rural household wastes 7.52 kg of grain per year, and each person wastes 1.93 kg of grain per year (in our sample, each household has an average of 3.89 people)[4]. This number is much lower than that in high-income countries and Chinese urban restaurants[5]. Although the amount and severity of food waste in rural households are lower than those in urban households, given China's large population and scarce resources, reducing rural food waste is still very important, especially in the context of the country's current rural revitalization strategy. As people's living standards improve, it is necessary to be alert to the increase in food waste in rural areas.

The proportion of household food waste increased from morning to night: 0.67% of total consumption was wasted during the dinner meal, 0.54% of total food consumption was wasted during the lunch meal, and 0.46% was wasted during breakfast. These findings reflect that many farmers leave uneaten breakfast food for lunch or dinner; in addition, breakfast is relatively simple for farmers, and dinner is the most important meal. Since the dinner diet is more abundant, it results in more waste.

Plant food waste was more serious than animal-derived food waste. For each meal, the most serious waste was staple foods; 3.01% of total flour products and 5.15% of total rice products were wasted each day. One possible reason for these findings is that the price of beef and mutton is higher than that of pork and the other foods listed.

China comprises a vast territory with various topographic, climatic, and economic conditions in different regions. These variations cause differences in people's eating culture (Carter and Lohmar, 2002). The food waste of rural households in different regions is shown in Table 4.

Rural household food waste is the most serious in East China; on average, 2.06% of total food is wasted during daily consumption. Household food waste in North China and Northwest China is relatively low: 1.19% of total food is wasted in North China.

Table 3. Household food waste in rural China (Unit: %).

	Flour products	Rice products	Potato products	Soybean products	Pork	Beef and mutton	Poultry	Aquatic products	Eggs	Total waste
First day										
Breakfast	1.08	1.71	0.94	0.34	0.18	0.02	0.08	0.10	0.31	0.53
Lunch	0.82	1.69	0.77	0.44	0.45	0.05	0.24	0.32	0.24	0.60
Dinner	1.25	2.11	0.62	0.41	0.61	0.07	0.30	0.44	0.28	0.71
Second day										
Breakfast	0.91	1.36	0.83	0.22	0.12	0.03	0.08	0.08	0.29	0.44
Lunch	0.83	1.59	0.76	0.47	0.44	0.07	0.26	0.25	0.21	0.57
Dinner	1.15	2.12	0.71	0.40	0.51	0.15	0.38	0.41	0.26	0.70
Third day										
Breakfast	0.96	1.23	0.73	0.27	0.13	0.04	0.05	0.09	0.23	0.42
Lunch	0.83	1.51	0.62	0.35	0.38	0.09	0.24	0.26	0.27	0.53
Dinner	1.21	2.14	0.56	0.47	0.50	0.08	0.22	0.54	0.31	0.69
Average										
Breakfast	0.98	1.43	0.83	0.28	0.14	0.03	0.07	0.09	0.28	0.46
Lunch	0.83	1.60	0.71	0.42	0.42	0.07	0.25	0.28	0.24	0.54
Dinner	1.20	2.12	0.63	0.43	0.54	0.10	0.30	0.46	0.28	0.67
Total	3.01	5.15	2.18	1.12	1.11	0.20	0.62	0.83	0.80	1.67

Table 4. Rural household food waste in different regions (Unit: %).

Region	Flour products (%)	Rice products (%)	Potato products (%)	Soybean products (%)	Pork (%)	Beef and mutton (%)	Poultry (%)	Aquatic products (%)	Eggs (%)	Total waste (%)
North China	3.95	3.81	1.54	0.44	0.35	0.06	0.15	0.12	0.32	1.19
Northeast China	1.86	5.39	2.50	2.10	1.32	0.28	0.57	0.86	1.31	1.80
East China	2.51	7.42	1.43	1.60	1.47	0.19	1.16	1.90	0.90	2.06
South-central China	2.62	5.31	3.15	1.03	1.30	0.18	0.92	0.98	0.99	1.83
Southwest China	1.91	8.00	2.00	0.72	1.36	0.10	0.47	0.86	0.64	1.79
Northwest China	4.99	1.58	2.31	0.41	0.71	0.30	0.21	0.05	0.38	1.22

East China is the most economically developed region, and farmer income in this region is also higher than that in other regions. Economic development and income growth facilitate the waste of greater amounts of food. We also find differences in the sub-items of food waste among different regions, which means that factors other than the level of economic development are also correlated with rural household food waste.

Major factors of rural household food waste in China

In Table 5, we report the estimation results of the FRM. The results show that rural households experience more waste if they use a modern cooker such as a pressure cooker or an electric cooker to process staple foods. In addition, the use of modern woks for stir-frying purposes reduces food waste. Pressure cookers or electric cookers have larger capacities than traditional staple food utensils, and the modern wok has a smaller capacity than traditional stir-frying utensils. Hence, these results show that the use of food utensils with a smaller or appropriate capacity is related to lower food waste. In addition, preparing the right amount of food is obviously correlated with lower food waste.

Religious beliefs are correlated with lower food waste. Religions generally encourage people to save food. Christianity, Buddhism, and other religious canons have proverbs that encourage believers to be frugal. Hence, we believe that farmers with religious beliefs have a stronger awareness of food saving, which can reduce food waste. The number of residents in a household and the average weight of family members are correlated with higher food waste. Generally, families with more members and heavier average weights prepare more food, which may cause more serious food waste.

The percentage of purchased grain among total consumption in 1 year correlated with lower food waste. Purchasing from the market gives farmers a direct economic signal, and direct spending can enhance farmers' awareness of food saving. Total grain output was significantly correlated with higher food waste. When food production is greater, the quantity of grain consumed by households increases, which may weaken farmers' awareness of food saving. As a result, food waste is increased.

Conclusion

With economic development, China is steadily moving from a backward agricultural country to a moderately developed country.

Table 5. Estimation results of major factors of rural household food waste.

Dependent variable: food waste as a proportion of total consumption (mean = 1.63)		
Variable	Coefficient	*Z* value
Cooking practices		
Staple food utensils: using a modern cooker such as a pressure cooker or an electric cooker (yes = 1)	0.21***	2.71
Using a modern wok for stir-frying (yes = 1)	−0.27***	−3.13
Using gas or electricity (yes = 1)	−0.13	−1.45
Discarding food without processing (yes = 1)	0.22	1.52
Preparing the right amount of food (yes = 1)	−0.17**	−1.96
Refrigerator (yes = 1)	0.13	1.04
Taste preference		
Cooking with monosodium glutamate (MSG) or chicken essence (yes = 1)	−0.03	−0.30
Preferring spicy food (yes = 1)	0.12	1.62
Decision-maker and household characteristics		
Sex of the decision-maker (male = 1)	0.01	0.10
Age of the decision-maker (years)	0.002	0.53
Years of schooling of the decision-maker	0.004	0.29
Religious beliefs (yes = 1)	−0.30*	−1.70
Number of residents in the household (at home for more than 180 days per year)	0.06**	2.47
Average age of the family members	−0.002	−0.43
Log value of average weight of the family members (kg)	0.60**	1.96
Socioeconomic variables		
Distance to the nearest town (km)	0.01	0.74
Log value of annual income (yuan[a])	0.07	1.24
Percentage of purchased grain among total consumption in 1 year	−0.71***	−7.47
Total grain output (tonne)	0.01**	2.53
Location dummy	Controlled	
Constant	−7.95***	−5.83
Observations	1615	

[a]Yuan is the Chinese currency unit, 1 USD = 6.55 yuan (December 23, 2020); Due to missing data, some samples were not entered into the model.
*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Based on 1634 survey samples from 28 provinces (municipalities and autonomous regions) in China, we first assessed the amount of food waste in rural China and then systematically analyzed the main factors correlated with rural household food waste in China.

This study found that, on average, 1.67% of food is wasted each day, and the waste of staple food is largest. In addition, rural household food waste is most serious in East China; on average, 2.06% of total food consumption is wasted per day.

The empirical analysis showed that cooking utensils are significantly related to rural household food waste, most likely due to utensil capacity; pressure cookers or electric cookers have larger capacities than modern woks, which have a smaller capacity than traditional food utensils. In addition, preparing the correct amount of food is correlated with lower food waste. Hence, we must—through TV, radio, and other media channels—promote the use of utensils with an appropriate capacity and strengthen food-saving awareness to encourage farmers to prepare the right amount of food.

Households with religious beliefs have lower food waste, which may reflect greater food-saving awareness. Christianity, Buddhism, and other religions all advocate a frugal life philosophy. For example, Buddha regarded thrift as the method of practice. He always taught his disciples to cultivate compassion through thrift and saving. However, Chinese people generally have no religious beliefs, and only 4% of households in our survey believe in religion. Although we do not encourage people to believe in religion, food-saving awareness should be promoted through various channels.

The average weight of family members is correlated with higher food waste. This finding warrants closer attention. With improving living standards, obesity in China has become increasingly prominent. The National Health Commission of the People's Republic of China reported that the rates of overweight and obesity among residents of all age groups in urban and rural areas continue to rise. The overweight and obesity rates of adult residents are 34.3% and 16.4%, respectively[6]. The government should encourage people to develop a healthy living concept, consciously control their weight, and eat moderately, which is not only beneficial to health but also reduces food waste.

This study revealed the current situation of food waste in rural China. It also has some shortcomings, and some issues need further research. First, our survey did not obtain data on the waste of vegetables and fruits in rural households. The consumption of vegetables and fruits has become an important part of the daily consumption of rural residents. In 2019, the per capita consumption of vegetables and fruits of farmers was 89.5 kg and 43.3 kg,

respectively[7]. The consumption of vegetables and fruits by farmers ranks second among all food categories, behind only staple foods. Hence, it is necessary to assess and analyze the waste of vegetables and fruits by farmers in the future. Second, we did not consider the food waste of farmers when eating outside of the home, which may lead to an underestimation of food waste by rural households. Third, although we considered the food waste of farmers in different regions, we did not consider the impact of other factors, such as culture and environment, on food waste. However, our study still has unique value, as it reveals the situation of food waste in rural China during an economic transition period and provides an estimate of food waste except vegetables and fruits, which is significant for developing food policies.

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Notes

1. Data source: World Bank Database, http://data.worldbank.org.cn.
2. For example, they bought too many ingredients at once, and some ingredients were not fresh after being left for a period of time. These farmers would discard them.
3. For example, some farmers cook a slightly more at noon and save it to eat at night, which can reduce the processing time for dinner.
4. Currently, annual food consumption by Chinese residents is equivalent to 450 kg of raw grain (Luo et al., 2020).
5. 173 kilograms per person in Europe (Stenmarck et al., 2016); 38.44 g/cap/day, equals 14 kilograms per year per person in China (Min et al., 2020).
6. Data source: Chinese Residents Nutrition and Chronic Disease Report 2020 (in Chinese), http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/42311/44583/index.htm
7. Data source: China Statistical Yearbook 2020, http://www.stats.gov.cn/tjsj/ndsj/2020/indexch.htm

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