
THE EVOLUTION OF FOOD CONSUMPTION AND THE DIRECTION OF FOOD TECHNOLOGY DEVELOPMENT IN CHINA

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ABSTRACT

China is the world's most populous country. Since its reforming from 1978, Chinese residents' food consumption has undergone enormous changes. China's food consumption is not only a matter of concern to the development of the nation's agriculture, but also influences the world's agricultural markets while China's agricultural imports increase rapidly in recent years. It is crucial to grasp the changes in food consumption trends in China. Therefore, this paper tends to summarize the resident's food consumption characteristics with the data provided by FAO, OECD, the World Bank and China Statistical Yearbook. However, it's not enough to reflect the overall Chinese consumption characteristics of different groups. Because of China's long-standing urban-rural dual structure and the rapid development of urbanization in China, China has three consumer groups, such as citizens, farmers and migrant workers, so this article analyzes the gap of food consumption between urban and rural residents, and gives a brief description of migrant workers' food consumption. On this basis, this paper analyzes the reasons why changes occur and why differences exist between urban and rural residents. At the end, we will predict Chinese food consumption trends of the future, and propose development direction of Chinese food technology accordingly.

After our analysis, structure upgrading, quality improvement and diversification in consumption patterns are the three main changes. Upgrades in the structure: direct consumption of grain reduction, indirect consumption increasing; animal food grew faster than plant food. On the quality improvement: the quality of food improves continuously and residents concern food safety more closely. On diversification: Eating out expenditures rose; purchases of imported food are increasing. But under the overall trends, there is a huge difference between urban and rural residents, especially in meat, poultry eggs and milk, and the gap is narrowing because of the lack of eating out and non-purchase of real spending data. Food consumption expenditure of migrant workers is high, but the food structure is not yet sure due to lack of data.

Research shows that changes of Chinese food consumption depend mainly on the income increase and the level of urbanization in rising China. In addition, food preferences and the Chinese food market also contributed to the improvement of China's food consumption changes. Differences between urban and rural food consumption are related to income differences, food availability and consumption concept. Trends in China's future food consumption will continue: First, rations continue to reduce, steering to increase feed, processing grain; animal food consumption continues to increase. Second, requirements for food quality further improve; demand for fresh food, processed food, safe food will be further expanded, and the demand for food safety will be higher. Third, consumption of eating out and imported food will rise. Therefore, the Chinese food technology development directions are: 1) increase production technology to guarantee both quantity and quality; 2) improve and innovate processing technologies; and 3) develop refrigerated cold chain technology.

KEYWORDS

Food, Consumption, Trends, Technology

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The Evolution of Food Consumption and the Direction of Food Technology Development in China
中国食料消費の変化と食料技術開発の方向

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背景 Background

- ◆ Resident income increased rapidly since China's economic reform in 1978
- ◆ Besides, urbanization level of China is continuously rising.

	1980	1990	2000	2012
GDP per capita (yuan)	463	1644	7858	38420
Urbanization level (%)	19.39	26.41	36.22	52.57

➤ Great changes took place in China's food consumption

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背景 Background

- ◆ Engel's coefficients are continuously declining
- ✓ The Engel's coefficient of urban and rural declined by 21.3% and 28.4% respectively from 1978 to 2012

Figure 1. urban and rural Engel's coefficient in China
 Data source: China Statistical Yearbook

- ◆ Quantity increased; Quality improved; Structural upgrading; Patterns diversified

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**食料消費の特徴
 The characteristics of China's food consumption**

- ◆ Quantity increased
- ◆ Structure upgraded
- ◆ Quality improved
- ◆ Patterns diversified

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Quantity increased

Table 1. Consumption volume of kinds of food in China(1980 as baseline)

	1980	1985	1990	1995	2000	2005	2009	2012
Cereals	100	124	132	136	136	133	133	20668
Vegetables	100	170	233	370	613	741	865	43904
Fruits	100	162	260	534	753	1040	1345	98717
Vegetable Oil	100	149	223	252	267	314	383	12156
Meat	100	142	205	327	430	486	541	79460
Eggs	100	191	282	589	763	849	953	25201
Milk	100	162	231	314	413	1041	1357	40719
Aquatic	100	143	226	460	593	706	823	54126

Data source: FAO

- ◆ Direct consumption of cereal is almost stable now;
- ◆ Consumption of vegetable oil rose steadily;
- ◆ Consumption of other food increased by at least 4 times, even 12 times for fruit and milk

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Quantity increased

◆ Support conditions

A **Domestic supply** capacity improved

Table 2. Output per Capita of cereal, meat, aquatic and milk in China

Unit: Kg

	1980	1985	1990	1995	2000	2005	2010	2012
cereal	327	361	393	387	366	371	409	437
meat	12.3	16.8	22.1	27.4	37.6	42.0	45.8	47.4
aquatic	4.6	6.7	10.9	20.9	29.4	33.9	40.2	43.7
milk	1.2	2.4	3.7	4.8	6.6	21.1	26.7	27.7

Data source: China Statistical Yearbook

✓ Per capita availability of cereal, meat, aquatic and milk improved greatly

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Quantity increased

◆ Support conditions

B **More imports**

✓ Imports of agricultural products like cereal, soybeans, vegetable oil, meat and sugar increased significantly.

✓ China transformed to a net importer of agricultural products in 2004, after that the deficit continued to expand. China **imported \$ 112.44 billion** and **exported \$ 63.19 billion** in 2012. The deficit amounted to **\$ 49.2 billion**.

2012 Unit: thousand tons

Soybean	Rape-seed	Vegetable oil	Meat	Sugar	Dairy	Milk powder	Net import				
							Cereal	Wheat	Rice	Maize	Barley
58380	2930	9600	2200	3700	1050	560	13170	3420	2090	5150	2520

Data source: China agriculture trade development report

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Structure upgraded

◆ Consumption of staple food declined; vegetable, fruit and animal food grew swiftly

Figure 2. Supply quantity of kinds of food per capita per year

Data source: FAO

✓ Staple food consumption per capita was 151.4kg in 2009, which decreased by 10kg from 2000, 20kg from 1990, and even below the 1980's level

✓ Consumption of fruits and vegetables increased; Meat, eggs, milk, fish consumption increased rapidly

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Cereals consumption structure

◆ In 2011, Feed 40%, food 30%, industrial use 20% (Ref: China Land and Resources News)

✓ Feed increased by 29.3%, 3.95 million tons from 2000 to 2011

✓ Industrial use of cereals increased by 76.9%, 4.14 million tons from 2000 to 2011

Figure 3. Consumption of feed and industrial use of cereals 2000-2009

Data source: FAO

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Meat consumption structure

Table 3. Meat consumption structure

Unit: %

	1980	1990	2000	2009
beef	2.76	3.94	8.33	8.42
mutton	3.45	3.54	4.38	5.09
pork	82.07	79.53	65.83	64.39
poultry	11.72	12.99	21.46	22.11

Data source: FAO

✓ Pork has the lion's share in spite of decreasing trend, followed by poultry which has an increasing trend.

✓ Beef and mutton took a comparatively small share, but with slow growth.

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Quality improved

◆ The expenditure of green and organic food is increasing

✓ China's urban residents paid more money on green food, from 87.1 yuan in 2007 to 428.1 yuan in 2008, increasing nearly by 4 times. Expenditure on organic food also increased from 66.1 yuan in 2004 to 293.4 yuan in 2008, increasing by 344% in four years (Wang et al. 2010)

◆ More concerns on food safety

✓ Chinese consumers have a great underlying demand for food safety. With the diversification of food consumption, consumers have higher requirement on food quality and safety.

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Table 4. Annual consumption of food per capita (Urban & Rural) Unit: Kg

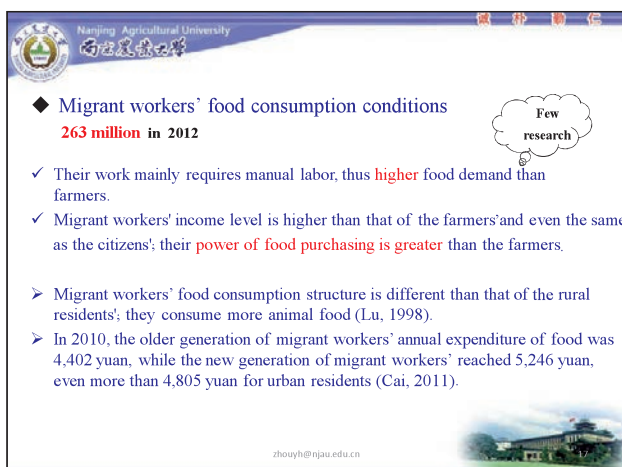
	1990		2000		2010		2012	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Cereal	130.72	262.1	82.31	250.23	81.53	181.44	78.76	164.27
Oil	6.4	5.2	8.16	7.06	8.84	6.31	9.14	7.83
Vegetable	138.7	134	114.74	106.74	116.11	93.28	112.33	84.72
Meat	25.16	12.59	25.5	18.3	34.72	22.15	35.71	23.45
Eggs	7.25	2.41	11.21	4.77	10	5.12	10.52	5.87
Dairy	4.63	1.1	9.94	1.06	13.98	3.55	13.95	5.29
Aquatic	7.69	2.13	11.74	3.92	15.21	5.15	15.19	5.36
Fruit	41.1	5.9	57.48	18.31	54.23	19.64	56.05	22.81

Data source: China Statistical Yearbook

For rural residents 2012

- ✓ Consumption of **cereal** is **2 times** than that of urban residents'
- ✓ Consumption of **dairy, aquatic and fruit** is **less than half** of the urban residents'
- ✓ Consumption of **Oil, eggs and meat** is **above half** of the urban residents' more or less

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- ◆ The reasons for the differences of food consumption between the urban and rural residents
- ✓ Income gap

	1980	1990	2000	2012
Per Capita Annual Disposable Income of Urban Households (yuan)	477.6	1510.2	6280.0	24564.7
Per Capita Annual Net Income of Rural Households (yuan)	191.3	686.3	2253.4	7916.9
Ratio (urban/rural)	2.5	2.2	2.8	3.1

- ✓ Food availability
- ✓ The difference of consumption concept (urban and rural living environment and cultural background)

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四 食料消費の動向 Trends of food consumption in China

- ◆ Rapid growth of population and its structural changes
 - ✓ Population of China is expected to be **1.5 billion** around 2033, thus greater demand for food.
 - ✓ Urbanization rate reached **70%** around 2030(Chen), almost **1.05 billion** urban people rely more on commodity grain and meat, eggs and milk.
- ◆ Rapid increase in household income
 - ✓ GDP growth potential can be kept at **8%** for **two decades** (Lin,2012)
 - ✓ Increasing growth of income strengthens the purchasing power

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四 食料消費の動向 Trends of food consumption in China

- ✓ Quantity of food consumption will continuously increase
- ✓ Proportion of animal food consumption will improve
- ✓ More attention on nutrition, quality and safety of food
- ✓ More frequent dining-out

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五 食料技術の開発方向 The direction of food technology development in China

Several constraints for China's food supply

- ◆ Natural resources constraint
 - ✓ Arable land per capita is 1.38 acres, **1/3** of the world averag
 - ✓ Water resource per capita is 2000 cubic meters, **1/4** of the world average
- ◆ Labor constraint
 - ✓ Substantial reduction of rural surplus labor force
 - ✓ Rising labor costs

Food supply depends on food technology development

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五 食料技術の開発方向 The direction of food technology development in China

- ◆ Production technology : the quality is as important as quantity, quality priority
 - For domestic supply security
 - GM and breeding technology
- ✓ China has approved **cotton, rice, corn and papaya** for transgenic production and application up to now
- ✓ China approved **896** new breeds in the last 5 years and had more than **6600** certified seed companies in 2011

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◆ Processing technology: Innovate and improve technology for commercialization

- Responding to diversified demand, develop intensive processing technology for high quality and high security
- Responding to frequent dining-out
- Develop functional food and health food

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◆ Circulation technology: cold storage and cold chain are the keys

- Modern logistics technology
- Standardization technology
- The circulation technology of agricultural products in the age of e-commerce

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Chair Ando: The second presenter is Dr. Zhou Yingheng, so-called “Shu-sensei” in Japan. He is now a professor at Nanjing Agricultural University. The title is “The Evolution of Food Consumption and the Direction of Food Technology Development in China.” I heard that he is better at Japanese than English, so he will make a presentation in Japanese. It may be very easy to understand, so please start.

Dr. Yingheng Zhou: Good afternoon. I shall speak in Japanese. First of all, thank you very much for giving this honor of making a presentation regarding the situation in China at this important symposium. I'd like to express my gratitude to the organizers.

The theme for today's presentation is “The Evolution of Food Consumption and the Direction of Food Technology Development in China.”

This is the outline. So the good and the bad in China can have an impact on Asia as well as globally in terms of food, but with respect to my presentation I'd like to talk about the characteristics of China's food consumption, as well as the trends going forward.

As you know very well, China embarked upon reform in 1978 in driving the economy forward and resident income has increased significantly. However, the urbanization level of China is continuously rising, giving rise to changes in food consumption as well.

At the end of last year, the urbanized population percentage reached about 52.6 percent. Now against this backdrop of economic growth as well as increasing income, the Engel coefficient has changed in the past 35 years.

The Engel coefficient of the urban and rural declined by 21.3 percent and 28.4 percent respectively from 1978 to 2012. Currently it is 36 and 39 percent, respectively. So a significant change has been observed.

In terms of the characteristics of China's food consumption, first and foremost, quantity has increased. Second, the structure has been upgraded. Thirdly, quality has improved. And fourthly, patterns of consumption have diversified.

This is looking at the trend in terms of the quantity increase. Please refer to this table. For nearly 30 years, in China the food consumption has increased. But in terms of cereal consumption, trends have remained stable, but fruit and vegetables, consumption has been rising significantly, at fast speed. And the consumption of vegetable oil is increasing steadily as well but the speed is slower; otherwise, other food products increased significantly. Fruit and milk have increased four to 12 times.

Now against this backdrop of significant increase, the domestic supply has been in the following manner. For cereals, in the past 34 years there was some increase but not significant growth, but in terms of meat as well as aquatic, fish, seafood, as well as milk, output per capita has increased significantly. The per capita output can be seen in this table.

But domestic production did not suffice; therefore, in the past ten years imports have been increasing significantly as well. For last year, in 2012, if we look, China imported 112.44 billion and exported 69.19 billion, so the deficit amounted to 49.2 billion dollars. This trend has continued from 2004.

As mentioned in the first report, the self-sufficiency of Japan has not declined, but China for cereal was 88 percent, about, as I said, it has been decreasing. And for the first half of this year, imports have increased by 36 percent.

This is looking at the structure upgrade in terms of consumption. For cereals, from the 1990s, it has been on a decreasing trend, and in its place, vegetables, fruit, and meat and processed food, the consumption has been increasing significantly at a fast speed.

Looking at the total, from 2011, in terms of feed, it's accounting for 40 percent, food accounting for 30 percent, industrial use for processing is accounting for 20 percent in terms of the cereal consumption structure.

In the past 12 years, feed increased by 30 percent, processing use or industrial use of cereals increased by 77 percent. Therefore, feed and industrial use of cereals have been driving demand.

Let's look at the details. Beef was prevalent. In 1980 it was 82 percent but it is coming down to 64 percent, but mutton and poultry have been increasing quite significantly in terms of the ratio. Quality improvement has been made as well. As already presented today, in China, in a similar manner, organic food is increasing. Demand for such products is increasing significantly.

Now in terms of the resulting expenditure, the ratio of organic food is increasing. For 2008, an increase of four times was seen from 2001. There was also heightened concern about food safety as well. Chinese consumers have great underlying demand for food safety.

Let's now look at the diversification of the consumption patterns. In the urban area, various data are being collected through research. For 2012, for urban residents, the ratio of dining out is accounting for 21.8 percent. Dining out is accounting for 21 percent of total food expenditure. Therefore, restaurant business revenue has increased by a factor of ten over the past 12 years.

There have been changes in terms of the purchasing channels as well. The traditional channel is the farmers' market. From the farmers, in the past 20 years this structure has not changed. Supermarkets have increased, so the distribution revolution that has taken place in Japan is now taking place in China as well.

Labor cost is also increasing. And a significant change is e-commerce as well. Using the internet, agricultural product transactions are increasing. And according to the past three years' data, from 2010 to last year, over the three years, for fresh produce, B2C market revenue has increased from 450 million to 4.5 billion, so an increase by a factor of 10 can be seen.

In terms of food consumption, there was a disparity between urban and rural areas, so there was a huge difference between the urban and rural residents in food consumption. This is because of the disparity in the economic structure, which is also reflected in food consumption.

The main food of rural residents has become grains, but for the urban areas, the grain ratio has come down and animal protein consumption is increasing. You can see that the consumption of cereal by rural residents is two times that of urban residents, but for dairy, seafood and fruit, the consumption in rural areas is less than half of urban residents. There is a difference of a factor of 2.5. For vegetable oil as well as for meat, the difference is even larger: for meat, 35.7 for the urban area and only 23 percent for the rural area.

This is data from the China statistical yearbook. Sorry, there could be some discrepancy with the other available data, compared to FAO.

The major reason is because the migrant worker numbers are not reflected in the national statistics. Migrant worker food consumption conditions must be taken into consideration. There were 263 million in 2012 and they have a higher income than farmers and they are young and they are involved in manual labor. Therefore, they have higher food demand but they are not reflected in terms of statistics for the rural area or the urban area.

Now according to Lu-san, in terms of meat consumption, the consumption is higher, and according to Cai-san's research, the young migrant workers' consumption of food is higher by 9 percent.

There is also an income gap as well. There is a difference of three times. The disparity in income is reflected in the disparity in terms of food consumption as well. And is also having an impact on the consumption environment as well.

Next I'd like to talk about the trends of food consumption in China.

In China, urbanization is accelerating. In 2033, the population will continue to increase and that will peak in 2033. So the population of China is expected to be close to 1 billion at that time. With the promotion of economic development, urbanization will be accelerated, so the urbanization rate will reach 70 percent around 2030.

Three hundred and fifty million will go to urban areas to become residents of urban areas, then the consumption behavior will be similar to that of the current urban residents. This will also drive demand for consumption. With the increase in income, food consumption is increasing according to the household income increase.

According to Lin, high economic growth should be continued for the coming 20 years having an impact on the income, and the increase in income will drive the consumption of food in China going forward.

In terms of the volume of food consumption, it will continue to increase and quality will be further emphasized. Also the proportion of animal food consumption will improve. There is also likely to be more attention on nutrition as well as quality and safety, as well as health. These factors are likely to have an impact on the food consumption in China in the future. Dining out is expected to increase as well.

Against this backdrop, I would now like to talk about the direction of food technology development in China which will be required to support the increasing demand.

Now quality has to increase and water resources will have to increase as well. There is 9 percent of arable land, 20 percent of water, and 40 percent of feed, or 20 percent of resources are now providing the support for 9 percent. But there are several constraints for China's food supply. And also, with economic development not just limited to the urban areas, there will be a shortage of area in the rural areas as well and costs are increasing. And agriculture is losing economic viability. This is likely to have an impact on agricultural production going forward. Therefore, in terms of food technology development we have to consider the following factors.

Production technology is very important. Quality is very important as well as quantity. If we are too dependent on the overseas market for supply, that will have a significant impact, and therefore, the national government would like to maintain the self sufficiency ratio at high levels domestically.

There is also GM, which is receiving much attention. There was a heated debate recently. The national government is promoting the technological development, but practical application is more prudent.

In terms of breeding technology, for rice and maize, papaya and for cotton, China has approved the testing for transgenic production. So we have to watch this very carefully going forward. Last year, there were 6,600 certified seed companies and breeding is making progress.

In the area of processing technology on the other hand, going forward there is increased emphasis in terms of health as well as nutrition and convenience of consumption, so these needs must be accommodated. Technology is required to realize this.

There are more people dining out; therefore, processing technology in this area will also be required.

There is more emphasis on health, therefore so-called functional food and healthy food development will have a significant market in the future.

Lastly, I'd like to talk about the distribution side. Cold storage and cold chain will be the key. Modern logistics technology is required, and in order to achieve safety, standardization technology must be developed as well. That will be an important focus for China in the future. In order to deal with the age of IT, the distribution technology of agricultural products in the age of e-commerce will be required.

So that is all in terms of my presentation. Thank you very much for your kind attention.

Chair Ando: Thank you very much for an interesting presentation. Are there any simple questions that you would like to make sure? Please state your name and affiliation.

Question: I'd like to speak in Japanese.

Chair Ando: Yes, I think that is more appropriate for Shu-sensei.

Question: Thank you very much for your presentation, Shu-sensei. My question is as follows. In the village areas, do you have the problem of aging population? I believe that in China, in terms of demographics in the rural areas, I'm sure that expeditious change is taking place. In the rural areas productivity could be further undermined with aging, which means that supply will be a challenge for the urban areas.

Dr. Zhou: Now in the rural areas, for agricultural management, according to your sample survey, in Japan the average age is 65 years old, 70 percent is accounted for over 65, but in China we are looking at the farmers above 60 in terms of labor force. It is above 30 percent already.

So compared to Japan, the education level is lower and there are people who are coming back from becoming migrant laborers in the urban areas, and therefore the labor force in the 50s has not been maintained. With the liberalization trend, agricultural production is not considered to be economically viable. Productivity is being undermined. However, the Chinese government is trying to not adopt the policy of Japan in the past. There is a special role in China. You cannot have private ownership of property, so when the young people go as migrant workers, the land in the rural area is provided to launch agricultural organizations. On the eastern coast, we can see significant change taking place. The average size is about 5 hectares; it's the minimum standard, so there is justification of land. And the maximum is about 20 hectares. So in the future, I believe it can be viable in the future.

Chair Ando: Thank you very much. Our time is limited but I forgot to mention earlier that inclusive of Prof. Linkham, please give them a big round of applause. Thank you.