

LINKING FOOD SYSTEMS AND HUMAN HEALTH: GEOGRAPHIC VARIATIONS IN CHINA

Anthony M. Fuller * Zheng Hong'e

College of Humanities and Development, China Agricultural University, 2 Yuanminyuan Rd, Haidian, Beijing, China

This paper is exploratory. It seeks to link the two dominant food systems of China with impacts on human health, as measured by the increasing but differential incidence of non-communicable chronic diseases. China is passing through the Nutrition Transition where traditional diets are being replaced by high fat and meat diets, high calorie snacks and meals with high protein and oil intakes. The argument is constructed on the basis that in general urban citizens increasingly consume processed foods manufactured by the industrial food system. Rural people on the other hand remain consuming their traditional diets. Process foods derive from industrial agriculture while local food is derived in a self provisioning way from small mixed farms growing grains and vegetables and keeping farmyard livestock; the so-called, 'one family; two systems' way of peasant farming.

The statistics from the China Yearbook, the North Carolina Nutrition study, 1993 to 2009 and the China Sanitation survey provide preliminary evidence to support this supposition at the macro scale. An associative link can be made that shows that food from the small mixed farm village environments is generally healthier than the fast food, processed diets of urban dwellers. This simplistic conclusion must be tempered by the effects of other life style behaviors that can also affect the health status of Chinese citizens, whether rural or urban. However, overall, there is evidence that suggests that as Chinese society becomes wealthier and more urbanized, the health status of citizens as measured by food related chronic diseases, becomes poorer. In terms of the incidence of chronic diseases, rural citizens are less at risk than urban citizens and this in large part is influenced by their food intake patterns which in turn reflect the two systems of food production (local and industrial) that prevail in China. The paper concludes with some reflections on what this paradox means for food system research in emerging economies such as China.

Key words: *nutritional transition diet farming system food urban and rural*

“China is undergoing a remarkably fast, but undesirable, shift towards a stage of the nutrition transition dominated by a high intake of fat and animal food, as well as a high prevalence of diet-related, non-communicable diseases such as obesity, diabetes mellitus, cardio-vascular diseases and cancer.” Fengying Zhai et al. 2002.

Introduction

The relationship between food and human health has become increasingly important. Whether as a component of eco-system health, epidemiology, food safety, public health or food security, the link is being explored in many different ways, the most prominent of which is in nutrition studies. Nutrition is one of the primary indicators of health, whether

in animals or humans, and the structure of nutrition, and changes in nutrition in-take over time, are one of the main ways to understand the role of food in human health.

This paper is based on the assumption that general trends in human health can be based on the food consumption patterns and related nutritional structures that are common in society. Food, however, is not only a commodity in the consumption patterns of a society, it is also deeply embedded in the cultural make-up of that society being part of many systems of activities that produce and preserve and consume food as a commodity. Food systems are distinguishable by the ways that food is grown and produced as an item for consumption. As such, the preferences, habits, taboos, tastes and traditions around food are part of a food culture which here we refer to as part of a 'life style'. Although there are many other components of 'life style', the role of food has become one indicator of the industrial progress of society. The more urban and industrial a society becomes, the more the food consumption patterns change (Du et al, 2004, Lang 2010). In general, it is also possible to argue that as food consumption patterns change, the health of consumers may also change. Taking disease rate changes for different regional cohorts over time as an indicator of health, this paper explores the potential effects of food system changes on the health of Chinese society. It does this by drawing attention to the regional and structural differences in food consumption patterns and associated incidences of chronic diseases. Moreover, the link between food consumption and health is extended to include the link with the food production systems in China.

The food system in China may be divided into two parts. There is the Commercial food system which produces food for the market from fairly large (for China) production units, with high levels of capital investment in the form of farm machinery, scientific agronomic technologies, and modern computer-based management practices. In this food production system the commercial food chain is long in which the raw materials are transformed into newly constituted foods such as in institutionalized food chains for educational, hospital, hotel and restaurant services, or manufactured foods for retail, characterized by long shelf life and colorful plastic packaging. In contrast to the industrial food system, there is the Local food system which produces food for the household, village and local market and only a small amount of product for the commercial food system. It is a short supply chain, of low capital intensity and high labor input. The food produced is not often transformed, but consumed directly in a relatively fresh food system, although there are many ways to store and cure food for later home consumption. In China, this dichotomy has been referred to by Zhou Li as the 'one family, two systems' way of farming and sustaining a livelihood (周立, 2010)

The health of Chinese citizens has been monitored in many ways. Perhaps the most significant indication of health status change has been recorded by UNC Carolina Population Center at Chapel Hill which published a variety of papers based on a longitudinal survey of over 4400 households between 1989 and 2009. This research among other things established a clear account of the 'nutritional transition' in China (Popkin et al., 2004). As increasing numbers of Chinese became wage earners and salaried workers, their dietary eating patterns shifted from the traditional emphasis on grains and vegetables to the higher consumption of meat and manufactured foods. This can also be stated that when people move into cities and enter the low-to-middle income wage range, their food preferences and therefore their dietary patterns change. The UNC Carolina Population Center concluded that the nutritional shift meant that the average Chinese was taking in fewer

proteins and eating more food with fats, sugars and starch and that overall this was of questionable benefit to their health (Popkin and Du, 2003).

The Nutritional transition has been noted for other Asian countries and marks the change in a society from agrarian to industrial conditions in which there is an on-going adjustment in life style from home cooking to eating out and an increasing dependency on fast food to accommodate, it is argued, a busy workload (Popkin et al.,2001, Zhai et al., 2002, Yamaguchi,1991,Popkin et al.,1991, Kim,1991). One can make other observations about lifestyle changes including increased smoking, decreased exercise as more people obtain cars or spend long hours on public transportation in burgeoning cities. It is in this way that the question arises as to whether, in China, there is a significant difference between the life style of the new middle class in the cities, and the continuing lifestyle of people who live and work in rural areas.

A number of questions arise around the issue of the nutritional transition. First of all, not all China can have experienced this transition at the same time, Chinese society being highly differentiated by age, region, ethnic background and economic status. The core question is whether there is a difference between urban and rural areas, or between the people consuming from the commercial food system and those in villages producing food largely for self-provisioning. This can be rendered to an even simpler question of whether demographics (eg, age) or geography (location) matter in terms of the nutritional transition and life style in China. Sufficient time has elapsed to offer information on some of these questions as Chinese urban society continues to develop rapidly and rural society remains essentially in place since the early millennium years.

It is important to note that in formulating the categories urban and rural, there are many discontinuities to bear in mind. For example, a large number of rural residents (those with their Hukou in rural villages and small towns) are working for the greater part of the year in cities. These 'nongmingong' (migrant workers) however are not counted as urban residents. This means that, in many villages there are mostly children, women and the elderly who are 'left behind' (Ye et al., 200). Such flows change the demographic structure of urban and rural places, but because of unreliable statistics cannot be accounted for in this broad argument about urban and rural food lifestyles.

An interesting and relatively new way of measuring this divergence between urban and rural food systems is to explore the health status of the two groups of citizens and to see whether by association there are important differences. This brings us to the question of health status of such demographic and geographic divisions in Chinese society. We will explore this question by building an association between food consumption in both rural and urban environments, by seeing if these patterns differ regionally and then by comparing these patterns with selected health status measures we will be able to shed further light on the broad health impact of the two food systems in China.

Methodology

Data Sources

The main sources of data are from China Statistics Yearbook between 1982 to 2010 and China Sanitation Statistics Yearbook between 2003 to 2010. Although the dates are inconsistent, they cover the transitional period (both Opening Up and nutritional transition) and provide a useful overview.

From the China Statistics Yearbook, we have used the data of per capita annual purchases of major food commodities of urban households, per capita consumption of major foods by rural households. These data belong to the People's Living Conditions part of the China Statistics Yearbook. All samples were drawn through stratified and random methods.

From China Sanitation Statistics Yearbook, we have obtained the data of the incidence of chronic diseases of the survey residents in 1993, 1998, 2003 and 2008; the per capita, per day food intake dose of urban and rural residents in 1982, 1992 and 2002, and per capita per day nutrient intake of urban and rural residents in 1982, 1992 and 2002. All samples were drawn through a stratified and random method.

In addition to these, we have used some data from the China Health and Nutrition Survey made by the international collaborative project between the Carolina Population Center at the University of North Carolina and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. The survey took place over a 3-day period using a multistage, random cluster process to draw a sample of 4400 households with a total of 26,000 individuals in nine provinces that vary substantially in geography, economic development, public resources, and health indicators.

Measures

All together there are six main variables, of which three are independent and three are dependent. Socioeconomic characteristics are used as the independent variables, which cover the demographic characteristics of regions, such as the total region in China, urban areas and rural areas. The statuses of daily living are defined as the dependent variables that are composed of three categories: 1) commodity consumption, including grain, vegetables, pork, beef, mutton, poultry, eggs, fish and its products, sugar, liquors, etc; 2) the nutrition structure, such as energy, protein, fat and carbohydrates; and 3) the incidence of chronic diseases, such as the endocrine, nutritional and metabolic diseases including diabetes; circulation system disease including hyper blood pressure and digestive system diseases, etc.

Among the three independent variables are nominal variables. All the regions in China are measured for 1) the total areas; 2) urban areas and 3) rural areas. The urban areas are measured for 1) the big cities (with more than 1 million population); 2) the medium cities (with a population between 300,000 to 1,000,000) and 3) the small cities (with a population less than 300,000). The rural areas are measured by the general standard of living for 1) the first type of rural area (Fuyu meaning very rich); 2) the second type of rural area (Xiaokang meaning well-off); 3) the third type of rural area (Wenbao meaning having enough to eat and wear) and 4) the fourth type of rural area (Pinkun meaning poor).

All three dependent variables are numerable. The commodity consumption is measured by the amount consumed per capita, per year. The nutrition structure is measured by the amount of nutrition intake per capita, per day. The incidence of chronic diseases is measured by the cases per thousand, per year.

Statistical Analysis

To answer the underlying questions in this paper, a series of statistical tests of association were conducted including frequency distribution, cross-tabulation, analysis of variance,

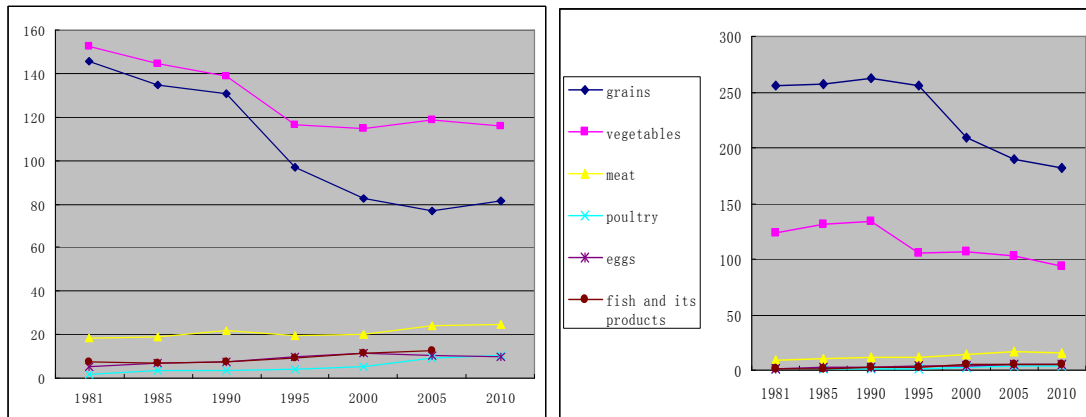
Chi-square significance tests, the measures of Cramer's V, and both Kendall's tau-b and tau-c. Frequency distributions not only disclose the differentiations of commodity consumption and nutrition structure in different regions, different urban areas and in different rural areas, but also the differentiations of incidence of chronic diseases in different regions, among urban areas and among rural areas. Analysis of variance is used to test if there is a difference in the incidence of chronic diseases in different urban and rural areas. Since one of the purposes of this study is to examine associations between the dependent and the independent variables, Chi-square is used because it is well-known for its significant association test for nominal variables (Fox, 2003). Since the variables used in this study involve both nominal and ordinal levels of measurement, to estimate the aptitudes of the association between variables, measures of Cramer's V, Kendall's tau-b, and tau-c were considered appropriate. Cramer's V is a Chi-square based measurement used to examine the strength of an association between nominal variables, while both tau-b and tau-c are best known for their ability to estimate the magnitude between and among associations of ordinal variables or numerable variables. These statistical methods serve the research purposes of this study.

Results

Food Consumption Patterns

In terms of food consumption in different regions of China and especially between rural and urban populations, the general pattern of the nutritional transition prevails over time. However, there are some important differences in the food consumption habits and these we would like to draw attention to. As expected, the human consumption of the grain staples (including cereals, beans and flours, etc.) in the diet of Chinese people falls consistently from 1981 to 2010 (40 percent overall), but always remains higher per capita for rural people than for urban (181kgs per person-rural versus 81kgs per person-urban, in 2010). The consumption of vegetables also falls in the dietary pattern (19 percent overall), but the annual consumption amount per capita is very similar between rural and urban people. As predicted by the nutrition transition thesis, the consumption of meat (beef, pork, mutton) rises appreciably, 69% between 1981 and 2010, but at a greater rate in urban than in rural. The consumption of fish also shows a strong increasing trend (126 % increase) with rural increasing by 302% (between 1981 and 2010) and urban by 73% (between 1981 and 2005). Needless to say, the annual amount of fish consumed in rural areas in 1981 was very low compared to urban (1.28 kgms in rural to 7.26 kgms in urban), providing a much greater opportunity for growth.

Chart One. Urban and rural commodity consumption per capita, per year, 1981-2010



When cross-checked with other data from the China Statistics Yearbook, the findings are similar. The consumption of so-called western-style foods increases rapidly, for example milk consumption in urban China increased by over 500% from 1982 to 2002, but with only a 56% increase in rural. Fruit and vegetable oils also show strong consumption increases in urban areas and together with meat and fish provide a clear shift in urban consumption patterns across China. Although not as large, a similar pattern is shown for rural areas, often delayed in various intervals. Because in 1982, the consumption amounts per capita in rural areas were appreciably lower than urban for many commodities, the potential for growth was higher. However, according to these statistics, the amounts per capita of food intake of the new industrial foods in urban China far outstrips that of rural China.

Nutrition Status

If there is a substantial difference between urban and rural food consumption amounts (even though the patterns are similar), then we turn to nutritional status data to see what this might mean in terms of the benefits and disbenefits of the nutrition transition. As is evident in the literature, there is often no simple or direct correlation between food intake, nutritional value and human health. There are many other variables in the lifestyle and environment that influence the role of nutrition in the health outcome. Nevertheless, some important associative indicators can be gleaned from the data at the macro level.

By looking at selected nutrition groups we can learn something more about the potential health impact of the two food systems in China. Three dietary reference intakes are listed in Table 1. The energy intake measured in calories per capita decreases overall by 9.7% between 1982 and 2002 and declines among both urban and rural people by 13% and 8.5% respectively. Protein intake per capita also declines overall, but shows a 3% increase among urban people and a 3% decrease among rural dwellers. As seen in Table One, the intake of fat increases substantially for both urban (25%) and rural (84%) people. Popkin (2003) notes that the increase in fats and oils intake in the nutrition transition has potentially harmful effects on human health (Popkin 2003, 2010).

Table One. Per capita per day nutrition intakes of urban and rural residents,1982-2002

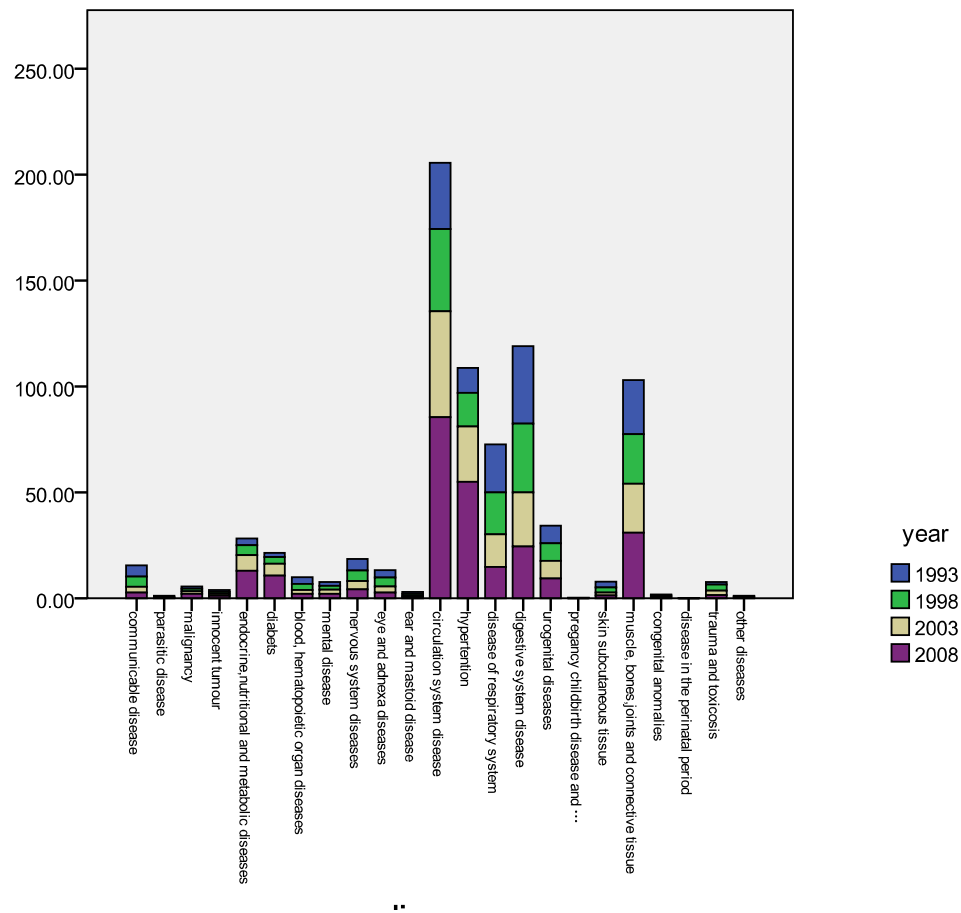
<i>Nutrients</i>	TOTAL			URBAN			RURAL		
	1982	2002	%Change	1982	2002	%change	1982	2002	%change
<i>Energy(cal)</i>	2491.3	2250.5	-9.67	2450. 0	2134.0	-12.90	2509. 0	2295.5	-8.51
<i>Protein(g)</i>	66.7	65.9	-1.20	66.8	69.0	3.29	66.6	64.6	-3.00
<i>Fat(g)</i>	48.1	76.2	58.42	68.3	85.5	25.18	85.5	72.7	14.97

Source: China Sanitation Statistics Yearbook, 1982 and 2002.

It is the nutritional link between diet and human health that is of most interest here. The link has been substantiated many times and with different measures and inferences. For China, the papers by the UNC Carolina Population Center are littered with inferences and hints about the probable impacts of poor nutritional balance and health, between the increasing amounts of protein from meat and the loss of vegetables in the standard Chinese diet.(Popkin et al.,2001, Du, et al.,2004, Kim et al.,2004,) There is also a substantial Chinese literature on this topic (翟凤英等, 2006; 王惠君等, 2003; 刘德宝, 2006; 李哲敏, 2007; 李哲敏, 2006; 许竹青, 2011 等; 赵法及等, 1991; 杜树发等, 2001; 马林茂等, 1999). However, as is also well known, nutrition is not alone in its effect on health and a variety of other behavioral factors such as smoking and the amount and type of exercise are also considered important. Such behavioral factors are commonly referred to as ‘life style’ factors and when added together with environmental measures such as exposure to pollution, water quality and social support, can, theoretically, be compiled into a health status index (Kim et al.2003). Such calculations are highly complex however and are by necessity subjective to a certain degree. Also, reliable data for such calculations are rarely available over time in a consistent format for developing nations.

Perhaps a more useful measure of food health in China is to explore the association between food systems and non- communicable chronic diseases. This can be done by tracing the incidence of chronic diseases by geographic area as represented by Provinces and by rural-urban splits, for the whole of China, within the provinces and within the rural and urban places themselves. Chart Two shows a range of chronic diseases for the whole of China divided into urban and rural splits for the period 1993 to 2008.

Chart Two. Incidence of chronic disease in China,1993-2008



What is immediately apparent from Table Two is that there is an appreciable difference between urban and rural incidences of several key diseases and that this pattern is not random. There is a greater incidence of two chronic diseases in urban areas, that is among urban people, than in rural. Endocrine nutritional disease is five times more prevalent in urban than in rural populations, and circulation system diseases (including heart disease, hypertention and cerebro- vascular diseases) occur twice as often among urban than rural people. These are important differences because both diseases can be directly related to diet and are key predictors of health status (Popkin 2009). The Chinese cultural imperative to demonstrate wellbeing by consuming large quantities of meat is a key factor in this situation, whether it be in the restaurant in the city or hosting relatives and friends in the countryside. Increased meat consumption is a major indicator of the nutritional transition of all Asian countries (Popkin 2001, Popkin et al.,2001,Mendez et al.,2005, Villavieja et al.,1991). However, although the trend is common in both urban and rural areas, the amount of meat consumed is much greater among urban populations per capita, per year. It is an enduring paradox that as society's become wealthier, the first signs of behavioral change in food consumption is of questionable benefit in terms of human health. It is also indicative of wealthier citizenry that as disposable incomes increase the proportion of income spent on food tends to decline. As incomes increase the first tendency is to spend more on what is perceived to

be better foods, often processed foods. However, in China this includes meat, fish and fruit. Only those who resort to fast food and oil saturated processed foods, and those rich in artificial sugars, are more likely to feel the negative affects of their diet over time. Hence the huge increase in digestive disorders and circulation problems as witnessed in urban China. As the nutrition transition progresses the second wave of change includes the tendency to spend proportionally less of disposable income on food.

Table Two. The incidence of chronic diseases of survey residents (%), 1993 - 2008

<i>Chronic diseases</i>	TOTAL			URBAN			RURAL		
	1993	2008	% Change	1993	2008	%change	1993	2008	%change
<i>Endocrine, Nutritional, metabolic diseases</i>	3.1	12.9	316	8.7	31.4	261	1.3	6.3	385
<i>Including diabetes</i>	1.9	10.7	463	6.4	27.5	330	0.4	4.8	1100
<i>circulation system disease</i>	31.4	85.5	172	78.6	153.3	95.04	15.5	61.5	297
<i>Including hypertension</i>	11.9	54.9	361	29.8	100.8	238	5.9	38.5	553
<i>digestive system disease</i>	36.5	24.5	-32.88	49.0	21.9	-55.31	32.3	25.5	-21.05
<i>muscle, bones, joints and connective tissue</i>	25.5	31.0	21.57	38.4	27.4	-28.65	21.2	32.3	52.36

Source: *China Sanitation Statistics Yearbook*

Exploring this question further, we can examine the existing data for cohorts of citizens in both urban and rural environments to see if any associative trends emerge between food production systems, dietary patterns and chronic diseases. This enables us to include socio-economic status as part of this broad analysis of food health.

Just as it is a little simplistic to speak about the health of all Chinese, it is also a gross generalization to speak about rural China as a whole. Most Chinese scholars speak about the many China's and it is self evident that in a country as big as China there are potentially some major regional differences. This assumption can be tested in a general way by examining some of the trends discussed in the paper at the Provincial level, the subject of another paper. To link food health with the two food production systems of China, a more appropriate way to break down the data into smaller and more meaningful units is to examine urban and rural categories to determine if there are variations in findings over time that support or refute the macro trends of association in the Chinese food health system.

When looking at rural –urban differences at the macro level, there are some clear and important differences. Unfortunately it is not possible with the public data available to analyze the comparative differences in more detail for sub-groups of rural and urban populations as the two main categories are divided based on entirely different criteria. For Urban, cities are divided according to population size (big, medium, and small cities). For rural there are 4 categories based on economic wellbeing (Fuyu, Xiaokang, Wenbao and

Pinkun; Rich, Well-Off, Ok and Poor respectively). Nevertheless there are some useful insights to be gained by looking more closely at this level of data for both urban and rural, individually, not comparatively, in terms of chronic diseases.

Taking the four rural categories as valid, there are some interesting differences between the more well-off rural places and those that are classified as poor. In terms of the incidence of all chronic diseases, the rate increases overall from 118 per thousand population in 1993 to 170 in 2008, which more or less covers the nutrition transition period for most rural areas. Interestingly, the total incidence of all diseases decreases for Poor rural areas and increases for Rich areas. This is shown in Table Three, together with the incidence rates for Diabetes and Hypertension, two key chronic diseases emergent today.

Table Three. The incidence of **diabetes** of rural residents in four types of rural area (%), 1993 to 2008

Incidence of diabetes	Fuyu (Very rich)	Xiaokang (Well-off)	Wenbao (ok)	Pinkun (poor)
In 1993	0.7	0.3	0.3	0.2
In 1998	1.7	0.8	0.7	0.3
In 2003	3.4	1.5	1.7	1.0
In 2008	8.2	4.9	3.8	1.4

$p < 0.001$; $\chi^2 = 83, df = 33$; Kendall's tau-c = -.425

Source: China Sanitation Statistics Yearbook

Table Four. The incidence of **hypertention** among rural residents in four types of rural area (%), 1993 to 2008

Incidence of hypertention	Fuyu (Very rich)	Xiaokang (Well-off)	Wenbao (ok)	Pinkun (poor)
In 1993	7.6	5.5	4.9	6.2
In 1998	11.4	7.5	7.5	4.4
In 2003	24.5	15.5	13.8	11.8
In 2008	65.2	34.4	34.1	15.7

$p < 0.001$; $\chi^2 = 781, df = 42$; Kendall's tau-c = -.470

Source: China Sanitation Statistics Yearbook

Table Five. The incidence of **diabetes** of urban residents in cities (%), 1993 to 2008

Incidence of diabetes	Big cities	Medium cities	Small cities
In 1993	9.2	7.1	3.2
In 1998	13.2	10.6	5.3
In 2003	22.5	17.6	8.3
In 2008	40.4	28.2	12.4

$p < 0.001$; $\chi^2 = 354, df = 22$; Kendall's tau-c = -.512

Source: China Sanitation Statistics Yearbook

Table Six. The incidence of **hypertention** of urban residents in cities (%), 1993 to 2008

Incidence of hypertention	Big cities	Medium cities	Small cities
In 1993	40.1	31.7	18.3
In 1998	52.9	42.8	20.7
In 2003	74.5	57.0	30.3
In 2008	132.0	106.9	61.0

$p < 0.001$; $\chi^2 = 1338$, $df = 22$; Kendall's tau-c = -.431

Source: *China Sanitation Statistics Yearbook*

It is interesting to note that the incidence of chronic diseases in cities shows a clear pattern of increased incidence of disease in larger cities than in smaller ones. In part, this may be an artifact of the unsatisfactory classification of cities by size, which lumps all cities above 1 million people into one category. Given the number of cities of population size above 4 million (*14 in 2010*) this is an out-of-date division which probably influences our ability to gain a full measure of health status affects by population size.

Discussion

Despite the irregularities in the data, the uneven coverage over time, and the questionable categorization of places there are some important insights which emerge from this descriptive analysis. It becomes clear, by the weight of circumstantial evidence, that there is a food-health association that is differentiated by geographical structure as well as by socio-economic status of Chinese residents. However, this geographical structure is not simply the regional variation that one might expect; it is characterized more by the distribution of urban and rural residential location than by region, although there is also a regional effect. Urban citizens who have experienced the nutrition transition early, who have middle-range incomes and have adopted typical urban 'life-styles' will be eating less healthy foods in their 'fast life-fast food' diets. These diets will consist of oil saturated restaurant food with MSG and salt applied liberally, of fast food in fast-food restaurants that are rapidly taking over prime locations in the major cities, and of processed foods for home consumption in the form of snack food, dairy products and sugar-filled soft drinks. This confirms for China what Lang (2010, pp 93) has noted for Asian countries in general:

(They) are all moving towards high consumption of fatty, sugary, processed (salty) foods and a lower than desirable consumption of fruit and vegetables,...

Although this may be true for urban China, the rural diet for the most part still consists of fresh vegetables, meat and eggs from free-range chickens, home cured pork and local fruits in season. Rural diets are inclusive of processed foods also, but to a much lesser extent than in urban areas. It is not clear what foods are provided in rural and small town schools.

The first link is therefore forged; that link between diet and place of residence where, in general, rural people have different diets than city dwellers. The second link is also

here made by association; that between diet and health as measured by the risk of chronic disease. Rural places have far fewer people with chronic diseases than urban places, although there are some work place hazards and diseases that are common mainly in rural environments (muscle complaints etc). Obesity, diabetes and cardio-vascular diseases are less common in rural than in urban areas, although they do occur more frequently in richer rural places (Fuyu) where the rates are steadily increasing. It is interesting to note that the incidence of such diseases increases rapidly in the biggest cities. Thus a pattern begins to emerge which suggests that ‘ample wealth does not mean ample health’. It is evident that life-style is of great importance in the question of good public health. By joining the two links together, we can conclude that in terms of the diet contribution to life-style, there is a difference of food consumption between rural and urban places that is largely mirrored by the differential incidence of non-communicable chronic diseases.

It is within the matter of life-style that further observations and questions can be raised. One of them is the question of gender. The differences of health risk by gender is not clear in the literature, which for some reason seems limited in China. In terms of life-style the most obvious gender difference is that high proportions of men smoke heavily, both in urban and rural places, while women do not, although they are often in the company of men who do. Women are probably more conscious of health risks than men, although both men and women appear equally aware of and avail themselves frequently of traditional Chinese medicines and cures. Such traditional practices are clearly more common in rural areas where there is a preponderance of the elderly in village populations.

The third and most important link that holds this argument together is that the food for the different lifestyles is produced in rural areas, but in two distinctive ways. Large scale farm operations produce materials for the food industry and are referred to by some officials as professional farms. Most farmers in China however are peasant farmers who have honed their ability to grow their own food, often in difficult physical conditions, can contribute to the local food economy and are essentially self provisioning. Importantly such self provisioning farmers use fewer chemicals in the production process (albeit because many cannot afford them), and generally consume less processed food in the household. Their fresh food diets are clearly more beneficial than those of many urban residents. Only the smoking habits of men puts them on a parallel with their urban counterparts in terms of health risks, although even there smoking in the open air may be marginally better than in closed city environments.

Conclusions

These observations suggest that perhaps it is time to re-evaluate the often despised way of life of the Chinese peasant. The ability of Chinese farm households to be selective about change is a form of resistance to food habit pressures, and represents a form of resilience in the face of price shocks and technological change. Such forms of small scale persistence, resistance and re-invention have been described by Vander Ploeg (2010 1 - 30) as a New Peasantry. This is reflected in other countries by the rise of new livelihood enterprises by small scale farmers who engage in nested markets, adopt multifunctionality or become pluriactive (Ploeg, J.D van der, Ye, and Schneider 2012, Milone 2009) in order to remain on the land and to make a living from it. Given the evidence of healthier diet and lower chronic disease rates in rural areas it is perhaps not a

bad option for many people whose livelihoods have been traditionally based on farming to remain in rural villages and to continue their way of life, albeit with as many improvements to their wellbeing as possible. Additionally, peasants and their ‘one family: two systems’ option support a food system that is much healthier than the highly capitalized mode of production that uses high dosages of energy, chemicals, growth hormones and anti-biotics for crop and animal production. The residues of these practices will inevitably show up in the food chain sooner or later as well as contribute to groundwater pollution and the overall degradation of the environment.

Officially, there are over 200 million peasant farmers in China. By maintaining this large cohort of self provisioning farmers and their families, there is a huge contribution to food security in the country. Not only are peasant farmers basically food secure, but have safe and relatively healthy food into the bargain. There are also low ‘food miles’ involved in the local food system. Of the two food systems, it is evident that the peasant farming mode is adapting well to new opportunities, can accommodate, at a price, the redistribution of manpower and is showing how well it has survived over the last millennia.

The nutrition transition demonstrates one aspect of how nations change from agrarian to industrial societies with all the well known and damaging consequences for people and the environment. Hopefully this paper will draw attention to the issue of differential food systems and how the ‘inevitability of modernization’ argument can be challenged. As nations mature in terms of urbanization and modernity, the question of food safety in relation to public health will continue to rise in the consciousness of the people and the state. It is important to realize that this link is not prescribed by these two parameters alone, but that the system of producing the food in the first place has a significant part to play in explaining food system dynamics in emerging economies.

References

- Barry M. Popkin Susan Horton, Soowon Kim, Ajay Mahal, and Jin Shuigao, Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: the economic costs of the nutrition transition, *Nutrition Reviews*, 2001,59(12):379-390
- Barry M. Popkin, The nutrition transition and obesity in the developing world, the *Journal of Nutrition*, 2001,131:871S-873S.
- Barry M. Popkin, Nutrition in transition: the changing global nutrition challenge, *Asia Pacific Journal of Clinical Nutrition*,2001, 10(Suppl.): S13-S18.
- Barry M. Popkin Susan Horton, Soowon Kim, Ajay Mahal, and Jin Shuigao, Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: the economic costs of the nutrition transition, *Nutrition Reviews*, 2001,59(12):379-390.
- Barry M. Popkin Eilene Z. Bisgrove, Urbanization and nutrition in Low-income Countries, 《国际食物、营养与社会经济发展讨论会论文集》, 中国科学技术出版社, 1991 版, 第 459-471 页。
- Barry M. Popkin, *The World is Fat : The Fads, Trends, Policies and Products That are Fattening the Human Race*. New York :Avery/Penguin,2009.
- Fengying Zhui, Dawei Fu, Shufa Du, Keyou Ge, Chunming Chen and Barry M. Popkin, What is China doing in policy-making to push back the negative aspects of the nutrition transition, *Public Health Nutrition*, 2002,5(1A):269-273.
- Fox, W. (2003). *Social statistics: A text using MicroCase* (4th ed.). Wadsworth Group.

Gracia M. Villavieja, Teresita E. Valerio, Evangeline R. Red, Cynthia A. Nones, Bernardita E. Raymundo, Trends in Philippine Food and Nutrition Situation in Relation with Some Development Indicators, 《国际食物、营养与社会经济发展讨论会论文集》, 中国科学技术出版社, 1991 版, 第 430-440 页。

Kenji Yamaguchi, Changes in Nutritional and Health Status in Japan after the Second World War, 《国际食物、营养与社会经济发展讨论会论文集》, 中国科学技术出版社, 1991 版, 第 394-401 页。

Michelle A. Mendez, Carlos A. Monteiro, and Barry M. Popkin, Overweight exceeds underweight among women in most developing countries, *Am J Clin Nutr*, 2005, 81:714-721.

Milone, P. 2009. Agriculture in transition: A neo institutional analysis. Assen: Royal van Gorcum.

Ploeg, J.D. van der. The peasantries of the twenty-first century: the commoditization debate revisited. *Journal of Peasant Studies*, 2010, 37(1):1-30.

Ploeg, J. D van der. Rural development through the construction of new nested markets: comparative perspectives from China, Brazil and the European Union, 2012, 39 (1): 133 - 173

Popkin BM, The nutrition transition: an overview of world patterns of change, *Nutrition Reviews*, 2004, 62(II):S140-S143.

Popkin BM and Du S, Dynamics of the nutrition transition toward the animal foods sector in China and its implications: a worried perspective, *the Journal of Nutrition*, 2003, 133:3898S-3906S.

Shufa Du, Tom A. Mroz, Fengying Zhai, Barry M. Popkin, Rapid income growth adversely affects diet quality in China particularly for the poor, *Social Science & Medicine* , 2004, 59: 1505-1515.

Sook He Kim, Ph.D. Changing Nutritional Status Affected by Rapid Economic Growth of Korea, 《国际食物、营养与社会经济发展讨论会论文集》, 中国科学技术出版社, 1991 版, 第 472-478 页。

Soowon Kim, Barry M. Popkin, Anna Maria Siega-Riz, Pamela S. Haines, and Lenore Arab, A cross-national comparison of lifestyle between China and the United States, using a comprehensive crossnational measurement tool of the healthfulness of lifestyles: the Lifestyle Index, *Preventive Medicine*, 2004, 38: 160-171.

Soowon Kim, Michael Symons, and Barry M. Popkin, Contrasting socioeconomic profiles related to healthier lifestyles in China and the United States, *American Journal of Epidemiology*, 2004, 159:184-191.

Soowon Kim, Pamela S. Haines, Anna Maria Siega-Riz and Barry M. Popkin, The Diet Quality Index-International (DQ I - I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States, *the Journal of Nutrition*, 2003, 133:3476-3484.

Tim Lang, Crisis? What Crisis? The Normality of the Current Food Crisis, *Journal of Agrarian Change*, 2010, 10(1):87-97.

Ye Jingzhong, Panlu, Differentiated Childhoods: Children Left behind in Rural China, *Social Sciences Academic Press(China)*, August, 2008.

Ye Jingzhong, Wu Huifang, Dancing Solo: Women Left behind in Rural China, *Social Science Academic Press(China)*, August, 2008.

Ye Jingzhong, He Congzhi, *Lonely Sunsets: The Elderly Left behind in Rural China*, Social Science Academic Press(China), August, 2008.

杜树发, 吕冰, 王志宏, 翟凤英, Barry M Popkin, “中国居民膳食的变迁”, 发表于《卫生研究》, 2001年第30期, 第221-225页。

李哲敏, “近50年中国居民食物消费与营养发展的变化特点”, 发表于《资源科学》2007年第1期, 第27-34页。

李哲敏, “中国居民食物消费与营养发展历程分析”, 发表于《中国食物与营养》, 2006年第10期, 第6-9页。

刘德宝, “国民营养转型的必要性、紧迫性与可行性”, 发表于《中国食物与营养》, 2006年第2期, 第10-11页。

马林茂, 金水高, 翟凤英, 于义涛, “用体重模型评价中国八省区成年人的健康和营养状况”, 发表于《中国公共卫生》, 1999年第15期, 第749-751页。

王惠君, 翟凤英, 杜树发, 葛可佑, Popkin BM, “中国八省区成人膳食脂肪摄入状况及变化趋势分析”, 发表于《营养学报》, 2003年, 第25期, 第230-233页。

许竹青, “转型时期我国食物安全与营养问题面临三大挑战”, 发表于《兰州学刊》, 2011年第10期, 第50-55页。

翟凤英, 王惠君, 王志宏, 何宇纳, 杜树发, 于文涛, 李婕, “中国居民膳食营养状况的变迁及政策建议”, 发表于《中国食物与营养》, 2006年第5期第4-6页。

赵法及, 郭俊生, 陈洪章, “食物结构与健康疾病关系的探讨”, 《国际食物、营养与社会经济发展讨论会论文集》, 中国科学技术出版社, 1991版, 第86-91页。

周立, 《极化的发展》, 海南出版社, 2010年版。