Eating patterns-- a prognosis for China

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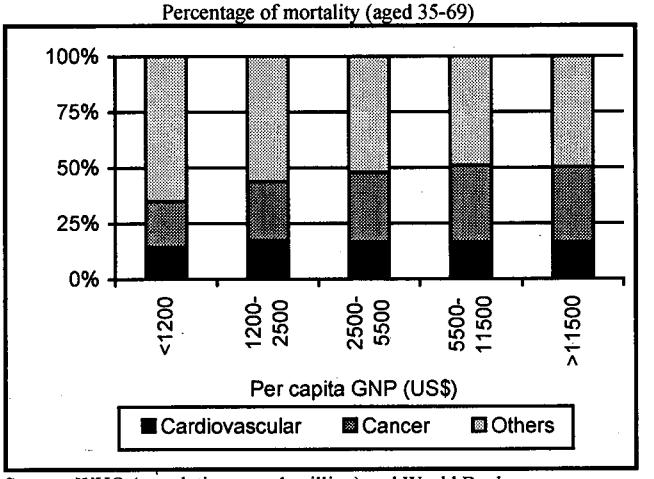
China has shifted its dietary patterns because of economic change. As people have more money to spend they buy more processed food which tends to be energy-dense and nutrient-poor. There are substantial differences in dietary patterns between urban and rural populations. Rural residents tend to maintain the basic traditional diet. while urban and richer rural residents tend to consume more high-fat food and processed sugar-based foods. If no action is taken to intervene or guide people's food consumption behavior: consumption of cereals, sugar and vegetables will decline; poultry consumption will increase; and the demand for beef, mutton, eggs and milk will increase. An analysis of food consumption in Shanghai during 1950-1982 revealed the mortality rate of heart disease, cerebrovascular disease and cancer were positively correlated with meat, egg and sugar consumption and negatively correlated with cereal consumption. The projections for chronic disease based on demographic change, risk factor and disease estimations indicate that by the year 2030 in China, there will be annually 800,000 deaths by coronary heart disease, 3 million from strokes and 1.7 million due to lung cancer. These figures call for the government and public to take timely actions to avoid over-consumption of animal foods. Although disease pattern change is related to a series of factors, the role nutrition plays in health promotion and disease prevention should not be underestimated.

Introduction

During economic development, food production changes to match the demand for food and food consumption behavior changes with income increase. Therefore, dietary pattern transition is a consequence of economic development. The major dietary changes in the United Kingdom over the past 200 years (1770-1970) were: fat went from 25g per person per day to 145g; sugar went from 10 to 150g; wheat flour declined from 500g to 200g; and crude fiber was reduced from 5g to 0.2g[1]. In the past 100 years (1850-1987) of the Japanese diet: rice intake was reduced from 350g to 212g; meat increased from 5g to 71g; milk increased from 0 to 118g; energy from fat increased from less than 5% to 24.5% accompanied by a reduction in energy share of carbohydrates from 84% to 57%[1]. In developing countries, economic adjustment policies, such as food exportation and increased demand for cash crops, often signal dietary pattern changes. Substantial differences in dietary pattern between urban and rural populations exist. Rural residents tend to maintain the basic traditional diet. Urban residents, especially the young generation who are influenced by local and international food industries, now tend to consume more high-fat food, processed sugar-based foods, soft drinks, alcohol and fast foods. The same trend occurs in the better off rural areas where lifestyle is becoming more urbanized. Traditional dietary patterns are under threat from the modern world regardless of whether they are good or bad.

Figure 1 is an analysis of the available World Health Organization (WHO) mortality data from 52 countries (with populations over 1 million) and the per capita Gross National Product (GNP) data from World Bank. It shows the mortality share of cancer and cardiovascular disease of people aged 35-69 in relation to GNP. Countries with GNP of US$1200 experienced a sharp increase of the two disease categories. In countries with GNP of US$3000-4000, the burden of the two diseases is nearly as great as in very affluent countries with average GNP more than US$11,500. A modest increase in prosperity in populations with low GNP seems to be associated with the most marked increase in the share of these chronic diseases, which pose a major long term burden on health services. The corresponding dietary changes of countries, based on FAO data, given in Figure 2 demonstrate the progressive energy from animal fat increase and that from carbohydrate decrease[1].

Figure 1. Death from diseases in relation to GNP



Source: WHO (population over 1 million) and World Bank

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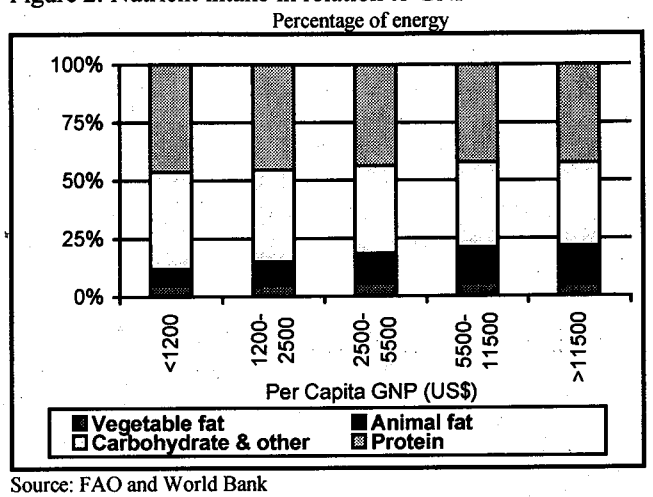
Figure 2. Nutrient intake in relation to GNP



Source: FAO and World Bank

In developing countries, communicable diseases will still be the predominant public health morbidity problem in the next decade. But with economic development, the prevalence and mortality rate of non-communicable diseases will become a long-term economic burden in terms of clinical health care costs and labor loss. Since the share of chronic disease mortality has been increasing for the past 20 years, its prevention and control is very critical. It is neccessary both to protect people's health and to gain economic benefit. China is now in this situation.

The evolution of food consumption and dietary patterns of Chinese people

Food consumption

In the early 1950's, personal expenditure was very low because socioeconomic limitations and low productivity. The per capita expenditure was equivalent to a current value of 76 Yuan RMB in 1952. After a 40 year effort, this increased 10 fold. Macro policies did not address the relationship between production and spending, so that spending fluctuated during this period of 1952-1988. Considered as 1952-1957, 1958-1978 and 1979-1988. Table 1 shows the variation in consumption of several food items and in energy and in macronutrients.

Table 1. Variation in food consumption (1952-1992)[2,3]

Year	Increase in:		Food consumption (kg/yr)			Nutrients		
	In come	Exp ense	cereal	oil	animal food	Energy kcal	Fat (%) Energy	Prot (g)
1952-1957	10.6	4.6						
1952			197.7	2.1	11.0			
1957			203.0	2.4	12.3			
1958-1978	5.3	1.8						
1978			195.5	1.6	14.3	1833	13.8	46.5
1979-1988	9.2	7.7						
1984			249.7	4.7	23.7	2532	17.1	61.0
1988			246.1	5.9	29.5	2625	17.8	62.8
1989			239.1	5.4	30.7	2535	19.1	60.9
1990			238.8	5.7	32.9	2524	20.2	61.3
1991			234.5	5.9	35.1	2550	20.7	61.0
1992			235.9	6.3	37.6	2597	21.3	62.2

The blocked increase during 1958-1978 reflected macro policies. Since the implementation of economic reform and the "Open Door" policy in 1978, the income and expenditure levels have significantly increased. Cereal consumption reached around 250 kg, animal food doubled, including an increase of pork by 90%, beef/ mutton by 100%, fish by 60%, poultry by 3.5 times, eggs by 1.9 times, and vegetable oil consumption by 2.7 times.

The above are data of national average consumption. Data were collected at the household level in 6 Provinces and Beijing Municipality in 1990[4]. They illustrate the food consumption of rural and urban households (Tables 2 and 3). There was a substantial difference between urban and rural populations. The increasing consumption of animal food and vegetable oil proved to be of similar magnitude. Along with the increase of animal food consumption and oil consumption, cereal consumption of urban households was reduced to around 120-150 kg per person per year. All sources of information show vegetable consumption was stable, at around 100-150 kg/ year for urban populations.

Table 2. Household food consumption of urban populations in 1990-- 6 provinces and Beijing[3] (kg/capita/yr)

	BJ[d]	HB	HL	NX	ZJ	GD	SC
Cereals	121	188	162	151	121	123	129
Animal food	59	41	36	45	52	63	48
Meat[a]	34	20	18	25		26	34
Poultry	5	3	4	8	5	8	6
Egg	14	12	8	7	9	13	4
Fish[b]	6		5	13	16	4	
Veg oil	9	8	9	11			8
Ani. fat[c]	6	11	10	8	5	13	

(a) including pork, beef and mutton (b) including fish, shrimp and oysters (c) added animal fat (d) BJ=Beijing Municipality, HB=Hebei Province, HL=Helongjiang Province, NX=Ninxia Hui Autonomous Region, ZJ=Zeijiang Province, GD=Guangdong Province, SC=Sichuan Province

Table 3. Household food consumption of rural populations in 1990 (6 provinces and Beijing) (kg/capita/year)[4]

	BJ[d]	HB	HL	NX	ZJ	GD	SC
Cereals	207	239	314	274	289	279	258
Animal food	18.1	8.7	17.3	12.4	19.6	27.8	21.2
Meat[a]	12	7	11	10	13	17	18
Poultry	0.7	0.3	1.7	0.4	1.7	4.8	0.9
Egg	4.8	2.9	3.7	1.9	2.4	2.3	2.3
Fish[b]	0.6	0.5	0.9	0.1	2.5	3.7	0.1
Veg oil	4.7	3.5	8.4	5.8	2.6	3.8	1.8
Ani. fat[c]	2.4	1.1	0.3	0.7	1.1	0.2	0.4

a,b,c,d: same as table 2

Dietary pattern

The Second Nationwide Nutritional Survey in 1982 indicated the national average of energy intake has reached over 102% of the Recommended Dietary Allowance (RDA) for Chinese people[5]. For the national consumption data from Table 1, the energy intake from cereals was 76% in 1978, declined to 73.3% in 1984 and 69% in 1992. Fat energy was 13.8% in 1978 and increased to 21.3% in 1992. This shows the national average change in dietary pattern.

Household data from 1990 (Table 4), show that energy intakes of both urban and rural households meet RDA. Fat intake of urban households was critically high with energy share from fat in 4 out of 7 provinces/ municipalities was over 25% and energy from cereals 52-68%, just at the optimal level. However, the dietary pattern of rural

households lacked quality, judged by food profile although average for fat enegy remained less than 20%.

Table 4. Household nutrient intake in 1990[4]
(6 provinces and Beijing)

	BJ	HB	HL	NX	ZJ	GD	SC
Urban							
Energy (kcal)	2166	2471	2238	2197	2160	2136	2286
% E from cereals	52.3	65.4	67.7	62.7	53.5	55.4	52.0
% E from fat	29.5	20.5	23.8	26.1	24.7	25.6	30.8
Protein (g)	70.2	79.8	70.9	77.5	75.4	70.5	66.2
Rural							
Energy (kcal)	2309	2227	2907	2402	2460	2425	2335
% E from cereals	73.2	81.9	77.4	83.4	80.2	77.6	78.2
% E from fat	18.0	13.9	17.0	12.7	12.1	14.4	14.3
Protein (g)	69.1	69.1	84.2	68.5	63.9	60.7	59.6

Future diet for the people of China

The following projection of the future diet for Chinese people is based on: (1) food consumption behavior of people, using urban household data of various income groups in 1990, (2) income elasticity of food items, (3) food demands of various categories of cities.

Food consumption behavior of income groups

The food consumption of income groups in urban areas in 1990 showed an increase in meat consumption, but little difference in cereal consumption among income groups. The meat consumption of the lowest 10% income group was 11-32kg/ capita/ year; the lowest 10% of households (group 1) in SC Province reached 32kg, only 5kg less than the highest 10% income groups (group 6). Beijing, ZJ province, GD province are similar with SC in differences between group 1 and 6. (Table 5)

Table 5. Meat and cereal consumption by income group* in 1990 (urban, 6 provinces and Beijing) (kg/capita/year)

	BJ	HB	HL	NX	ZJ	GD	SC
Cereal consumption							
Group 1	111	175	186	188	116	124	138
Group 2	126	174	180	189	120	126	136
Group 3	124	171	164	183	121	129	128
Group 4	120	171	170	181	121	123	124
Group 5	126	187	165	198	124	121	125
Group6	120	184	178	202	127	110	126
Meat consumption							
Group 1	30	15	12	11	15	22	32
Group 2	31	7	15	14	21	24	36
Group 3	32	8	14	18	19	26	42
Group 4	36	21	22	29	20	27	36
Group 5	37	24	20	29	18	28	34
Group 6	36	28	20	27	18	29	37

Group 1: households of the lowest 10 percentile of income, Group 2: 11-25 percentile, Group 3: 26-50 percentile, Group 4: 51-75 percentile, Group 5: 76-90 percentile, Group 6: the highest 91-100 percentile.

Recommended dietary guidelines for China include[6]:

1. Energy intakes of 2400kcal per day with 60% from cereals;
2. Protein intake of 70g per day contributing 14% of total energy intake, and 30-40% of protein intake from the combination of animal and bean/ pulse sources;
3. 25-30 % of total energy intake from fat;
4. Salt intake of less than 10 g per day.

Applying the principles of the Desirable Dietary Pattern (DDP) developed by the Regional Expert consultation of the Asian-Pacific Network for Food and Nutrition (ANFN)[7] a "DDP-China for 2000" was designed (Table 6). The quality of the dietary pattern can be evaluated by using DDP scoring (see Table 6). If intake of food items are not in balance with each other, the DDP score will be penalized.

Table 6. Desirable Dietary Pattern-- China 2000*

Food items consumed	% total energy	Rating	Score	Maximum limit of score
Cereals/ tubers	60	0.5	30.0	40
Animal foods	14	2.5	35.0	40
Added oil and fat	9	1.0	9.0	10
Beans & products	5	2.5	12.5	18
Sugar	5	0.5	2.5	
Nuts & seeds	2	0.5	1.0	5
Vegetable & fruit	5	2.0	10.0	15
Wine & drinks	0			
Total	100			

* (a) Example for calculation of the scores for food items: % of total energy from the food x rating = score, (b) Add all scores of food items = total score, (c) When score for food item exceeds the maximum limit of score, the score must be counted at the limit:
Example: when % energy of cereal = 85, 85 x 0.5 = 42.5 since the maximum limit for cereals is 40 the score must be limited to 40, not 42.5 as calculated.

The DDP scores of the urban income groups were mostly over 80 (Table 7). This means the dietary pattern has accomplished over 80% of the Nutritional Goal for 2000. Beijing was penalized for too much meat intake. ZJ province received a score of more than 100 due to high soybean product consumption in addition to a proper amount of animal food consumption so animal protein plus soybean protein reached 45% of total protein while the goal for 2000 is 40%.

Table 7. DDP score of urban household income groups[4]

Income group	BJ	HB	HL	NX	ZJ	GD	SC
1	93.8	79.1	72.3	77.3	100.7	93.3	96.8
2	94.1	83.6	78.4	82.4	107.3	96.2	96.2
3	93.4	86.5	80.9	86.5	107.5	97.0	96.5
4	94.7	89.3	82.1	90.0	106.5	96.5	95.4
5	95.1	89.3	83.0	91.7	107.0	96.5	95.4
6	93.6	90.0	85.9	92.2	105.9	96.0	94.6

Income Elasticity and Price Elasticity

The above data indicate the highest 10% income group does not always have an ideal dietary pattern. It depends on food choice behavior when income increases. It is necessary to analyze the Income Elasticity for food items. Analysis of the household survey data by the State Statistics Bureau during 1985-1989 shows the income elasticity of urban populations for animal foods to be fairly high. Poultry was highest, ranging from 1.0-1.06, 0.82 for milk, 0.79-0.90 for eggs, and 0.58-0.61 for pork. Price elasticity for pork during the same period was -0.36. Also low in price elasticity were cereals, sugar, vegetables and vegetable oil. Dynamic analysis of price elasticity of foods shows a declining trend for price elasticity of all kinds of animal foods during 1981-1987, which illustrated the increasing demand and affordability of animal foods to

Table 8. Projected food consumption (g per day) of urban residents in China by 2000[2]

	City category									
	I		II		III		IV		V	
	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000
Pork	19.2	32.5	14.3	14.4	13.0	15.8	18.6	17.3	24.8	25.4
Beef & mutton	3.1	4.8	3.2	6.8	7.8	12.3	1.8	5.3	1.7	3.6
Poultry	2.2	5.6	1.9	5.5	1.7	11.3	7.1	18.4	5.6	18.4
Egg	12.0	37.9	7.9	13.9	5.6	10.8	.4	13.3	5.9	13.1
Milk	10.8	20.8	7.1	8.0	11.4	23.1	12.8	58.3	6.5	14.9
Fish	5.8	7.0	5.9	6.0	4.2	7.4	11.4	8.7	6.4	7.2
Cereal	137.8	111.9	109.6	69.2	124.3	108.7	123.8	99.5	118.1	91.5
Vegetable	150.6	163.0	162.5	131.0	142.9	136.2	107.8	70.5	135.5	132.7
Veg. oil	7.7	12.9	5.8	10.9	8.2	15.5	8.0	11.4	6.8	12.5

urban people. It also alerts people to the possibility of an irreversible upward trend in animal food consumption[2,4].

Food demand in the future

Based on a series of indicators related to food consumption, cities were divided into six categories. Table 8 shows the projections for food consumption for city categories I to V in the year 2000. The projection was done by applying the secular changes of food consumption since 1987. If no action is taken to intervene or guide people's food consumption behavior: consumption of cereals, sugar and vegetables will decline; poultry consumption will increase by 2-5 times from 1987; and the demand for beef, mutton, eggs and milk will increase 1-2 times. These figures call for the government and public to take timely actions to avoid over-consumption of animal foods.

Trends in disease patterns

Increase in mortality of nutritionally related chronic diseases have occurred in China, Figure 3 compares the share of mortality of stroke, cancer and heart disease in China and the US during 1930-1980. The slope of the increase in China was steeper than that of the United States. The standardized mortality and the share of total mortality of diseases in China are shown in Table 9. The sum of mortality of stroke, cancer and heart disease was 65% of the total mortality in China in 1986, while it was 67% in the United States in 1985.

Table 9. Comparison of standardized mortality of major cause of death (/ 100,000)[8]

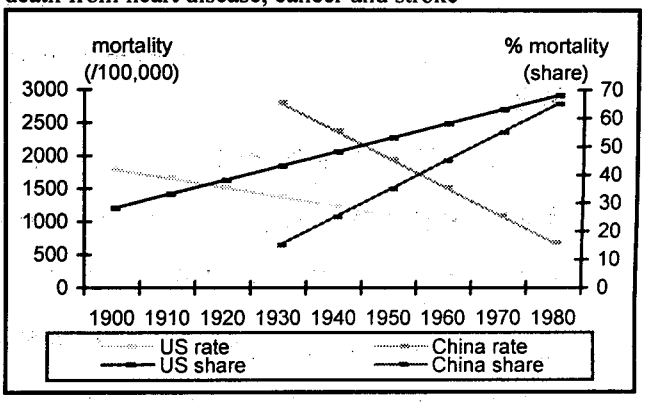
	Stroke	Cancer	Heart disease	Accident	Others
Mortality					
China -1986	123.9	109.5	176.4	54.5	140.0
USA-1985	32.3	132.5	200.3	34.3	133.4
% share of mortality					
China-1986	20	17	28	9	24
USA-1985	6	24	37	6	24

The survey of 9872 urban households in Beijing and six provinces in 1990, shows the prevalences of hypertension, coronary heart disease and cerebrovascular disease in all the provinces and Beijing in 1990 tend to be higher than the national average in 1986 (Table 10).

Table 10. Comparison of prevalence for chronic diseases in 1990 with 1986 (per thousand)[4]

	Hypertension	Coronary heart disease	Stroke
1986 survey	48.90	16.01	7.00
1990 survey			
BJ	99.96	80.13	20.23
HB	62.92	42.66	17.86
HL	55.70	53.30	20.89
NX	30.74	26.22	5.42
ZJ	60.22	41.57	7.78
GD	40.96	14.47	13.00
SC	48.56	22.45	16.84

Figure 3. China and US mortality rate and share (%) of death from heart disease, cancer and stroke[8]



The projections for chronic disease based on demographic change, risk factor and disease estimations indicate that by the year 2030 in China, there will be annually 800,000 deaths by coronary heart disease, 3 million from strokes and 1.7 million due to lung cancer. If an appropriate prevention strategy is adopted, shifting from treatment-focused to prevention-focused care, one third to half of the deaths could be avoided as well as many premature deaths[8]. Nutrition and diet is certainly within the reach of the risk factor family.

An analysis of food consumption in Shanghai during 1950-1982 revealed the mortality rate of heart disease, cerebrovascular disease and cancer were positively correlated with meat, egg and sugar consumption and negatively correlated with cereal consumption (Table 11). Although disease pattern change is related to a series of factors, in the light of people's recognition of the idea of a healthy diet and the cost-effectiveness of nutrition

intervention, the role nutrition plays in health promotion and disease prevention should not be underestimated.

Table 11. Food consumption in relation to disease mortality[2]

	Correlation coefficient		
	Heart disease	Cerebrovascular disease	Cancer
Cereals	-0.7009	-0.4542	-0.6067
Meat	0.9008	0.8236	0.7461
Egg	0.7892	0.4996	0.4929
Sugar	0.9359	0.8640	0.7891

The future

All of the evidence should alert people and government that timely food production planning, with formulation of nutrition policy, and orientation of food consumption behavior of people is required.

Recommendations for food production were made and a "China National Program of Food Structure Reform and Development in 1990s" was announced in 1993. Its aim is to plan economically sustainable food production for adequate and healthy nutrition. The Program substantially incorporates nutritional considerations and goals for the year 2000 into future production plans. Some of the aims are:

- to maintain the dietary pattern of Chinese people as a principally vegetable diet with moderate amounts of animal foods;
- to meet the nutrient requirements in terms of food items;
  to lower pork intake from the current 84% to 70% of meat production; to raise the poultry ratio to 20%;
- to encourage soybean production to avoid improper increases of animal food consumption for upgrading protein quality; and
- to promote vegetable and fruit production.

Public nutrition education will be extremely important in promoting the self-protection/ disease prevention capacity of nutritional improvement. The joining of actions by the community and government at all levels and by food industries in China, are at a crossroad. Either food products of good nutritional quality to promote a balanced diet or adulterated food products to devastate the dietary pattern. For all parties it is an issue of social responsibility for long-term rather than simply short-term benefit. Close collaboration between the community, government, science and industry in product development should be stressed.

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中国的膳食模式与未来

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摘要：

在国民经济发展过程中，人们的食物消费行为随收入的增加而变化，而膳食模式的演变又对疾病模式的变化发生重大影响。中国在近４０年来，居民的食物消费水平增长了１０倍。特别是１９７８年以来动物性食物、植物油和糖的消费增长迅速，而谷类消费呈下降趋势，蔬菜消费大致不变。作者以ＤＤＰ（理想膳食模式）为手段，对１９９０年７省、市的城乡膳食进行了评价。发现城市居民的膳食已基本满足２０００年膳食目标的８０%，而农村则尚有差距。作者认为在今后，粮食、蔬菜和糖的消费呈下降趋势，而植物油及动物性食物不断上升，以至对农业生产造成很大压力。对照我国近４０年来疾病模式的变化（传染病大幅度下降，慢性退行性疾病迅速增加），作者认为已有足够资料提醒人民和政府及时行动起来，从营养角度考虑食物生产计划及制定营养政策，以及引导人们正确的食物行为。

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