

Wuxi Citizens' Dietary Structure Report

Result 2 & 3 of the Live to Eat Project for the IB Diploma

Group Member:

Yu Ping'an (Leslie), Wu Weifeng (William), Guido Appoldt, Zhang Daiwei (David)

Abstract

Objective: To assess the nutritional status and dietary intake of residents in Wuxi.

Methods: Nutrients intake was assessed by 24-hour recall, combined with weighting method. Body weight, height and blood pressure were collected by physical examination.

Results: The average consumption of meat and oil was higher and the proportion of energy provided by fat was 45.3%. The intake of vitamin A, vitamin B2, vitamin C and calcium was deficient, which only counted for 67.5%, 57.1%, 75.8%, and 59.9% of RNI respectively. Rate of obesity and hypertension reached 21.2% and 23.1% respectively.

Conclusion: Dietary pattern among residents in Wuxi was not reasonable, and it should be modified by strengthening nutrition education.

Introduction

Along with the rapid development and the improvement in the living standard, Wuxi citizens are experiencing a drastic change in their living style and dietetic structure. In 1993, Wuxi's GDP per capita topped 1000 USD, and in 2003 it has reached around 5000 USD. (Various, 2010) As research has pointed out, the period when the GDP per capita goes from 1000 USD and up is essential and also when **the citizens' dietetic structure changes most rapidly**. (Fengying, 2005)

As students of the IB Diploma, the four members of our group have long been exposed to the western science philosophy. According to dialects of nature, science can be classified into three major phases, namely, ancient science, modern science and contemporary science. Gaps of age do exist among different phases in scientific standard. Ancient science stands out for its exploration for nature based on direct observation and inquiry; lack of argumentation based on experiment, it only gives speculation or subjective description, thus there is an obvious gap between ancient science and contemporary science. Such a gap only lies in scientific standard, and it only proves that ancient science fails to reach the level as high as that of contemporary science, but **ancient science is still rich in experience and can be re-used in modern age**. (Fang, 2001)

Chinese medicine, based on the ancient Chinese science, emphasizes phenomena description, experience summary, proposal and studies of hypotheses. In 2015, Tu Youyou, a Chinese pharmacist, was granted Nobel Prize in Physiology or Medicine for her discovery of artemisinin as anti-malarial medicine. When acquiring that the initial stage of Tu Youyou's great breakthrough was actually based on over 2000 ancient traditional Chinese

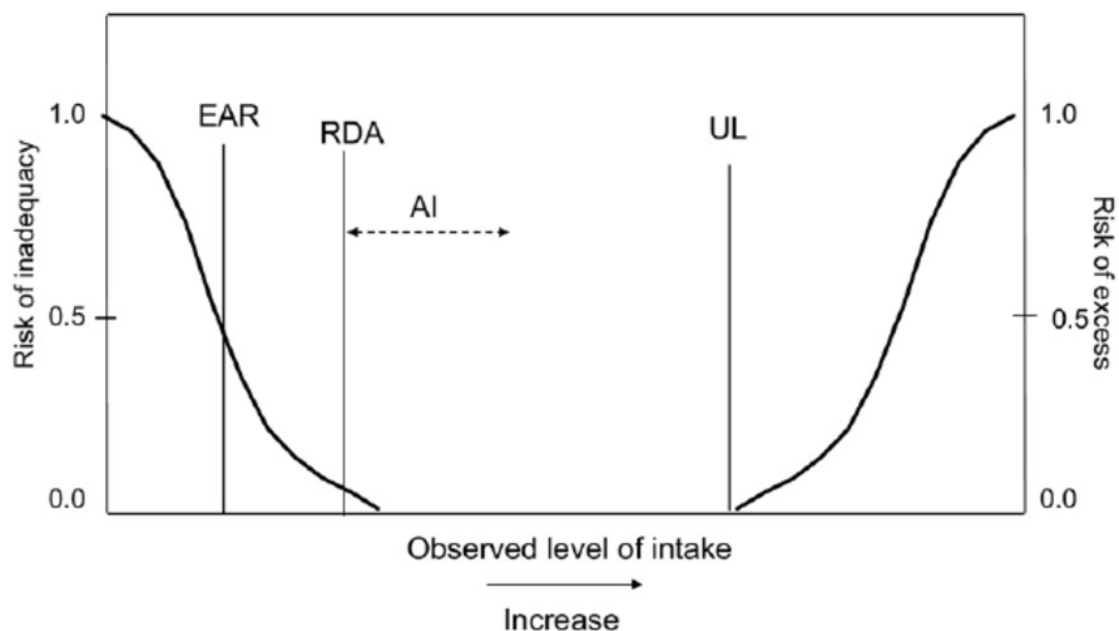
prescriptions, it ignited our group's interest in exploring other dietary heritage of traditional Chinese medicine. (Tu, 2011)

It is obvious that the exploration on life science by Chinese medicine during the several thousand years is still worth taking reference even under the theoretical system of modern science and medical care. Thus in this project, our group picked the Nutriology of Chinese medicine, the most important part of Chinese medicine apart from clinic treatment, as our research area.

Nutriology of Chinese medicine studies how to promote body health as well as how to prevent and treat diseases using food under the guidance of Chinese medicine theories. In order to investigate and prevent the potential obesity and high blood pressure caused by unhealthy daily diet, our group investigated Wuxi citizens' current dietetic structure from June to December in 2016.

Choice of Reference

In order to judge whether Wuxi citizens' dietary structure is healthy or not, we will need a standardized nutrition intake criteria as a reference. In this essay, the reference we used is the 2000 revision of **Chinese citizens' Dietary Reference Intakes (DRIs)** and the 2016 revision of **Chinese citizens' Dietary Guidelines and Balance Diet Pagoda**. Dietary reference intakes (DRIs) is a new set of daily references established based on Recommended Dietary Allowance (RDAs). (Yates, 1998) DRIs include four concepts:



(Murphy, 2011)

1. Estimated Average Requirement (EAR)

The intake levels to meet the requirement of 50% of individuals within a specific age, gender, or other physiological groups.

EAR is the foundation of RNI.

2. Recommended Nutrient Intake (RNI)

Similar to the Recommended Dietary Allowance (RDAs),

The intake levels to meet the requirement of most of individuals (97%~98%) within a specific age, gender, or other physiological groups.

RNI is the intake standard of an individual, if one's average intake level is higher than the RNI, it is said that the individual is in no potential of under nutrition.

The relationship between EAR and RNI

If the intake level follows the normal distribution, then the

$$RNI = EAR + 2SD$$

or RNI = 1.2 EAR (let CV = 10%)

3. Adequate Intake (AI)

The intake level of a specific nutrient of health people acquired through observation and experiment. The main purpose of AI is to serve as a target of individual nutrient intake. The establishment of AI considered not only the prevention of under-nutrition, but also included the prevention of potential diseases caused by over-nutrition.

Both the AI and the RNI can satisfy the majority of a group

But the AI is far less accurate than RNI

(Lack of research resources).

4. Tolerable Upper-level (UL)

The upper-limit of daily nutrition intake.

The main purpose of UL is to assess the possibility of over-nutrition. When the intake level is higher than the UL, the possibility of toxic side effect rises.

Research Method

To fully explore the DRIs of Wuxi citizens, two research methods were used.

Weighting Method

The first one is the weighting method. We weighted the food intakes of samples' different meals within three days.

1. Record, accurately, the food and condiments of different meals
2. Weight, accurately, the raw weight, cooked weight, remaining weight, snacks
3. Calculate the raw/cooked ratio,

$$\frac{\text{Raw}}{\text{Cooked}} \text{ratio} = \frac{\text{Weight of raw materials}}{\text{Weight of cooked materials}}$$

4. Categorized the food to calculate the daily food consumption of individuals
5. Calculate the daily food consumption of individuals based on the food composition table

(Yanping, 2006)

However, since the weighting method requires us to both record and weight accurately of the food intake, it is hard for us to apply such method on all the respondents. Therefore, we applied such method to only a small proportion of our respondents, and picked another method for the majority.

Reviewing Method

The second method we used is 3d24h review method. Through interactive questions and answers, our group reviewed samples' actual food intake over the last three days. This method is a lot more efficient than the weighting method because instead of holding a balance and weight the food house by house, we used standardized model to quantify the intake of nutrition. It means that if the respondent told us that she have had a small bowl of rice last night, we would assume that the rice intake to be 75 grams. The assumption we made

is based on the reference table of food weight published on an authentic Chinese Nutriology journal called *Acta Nutrimenta Sinica*. The reference table used is as shown below:

Reference table of food weight conversion				
Name of food	Unit	Raw Weight		Remarks
		g	Liang (g)	
Rice	Standard Bowl (Small)	75	1.5	D=12cm
	Standard Bowl (Large)	150	3	D=16cm
Rice Gruel	Standard Bowl (Small)	30	0.6	
	Standard Bowl (Large)	50	1	
Steamed Bun	Unit	100	2	Variable
Wet Handmade Noodle	Standard Bowl (Small)	30	0.6	0.8 of Flour's weight
	Standard Bowl (Large)	50	1	
Dry Handmade Noodle	Standard Bowl (Small)	75	1.5	1.0 of Flour's weight
	Standard Bowl (Large)	100	2	
Stuffed Bun	Unit	50	1	Varies
Dumplings	Average 6	50	1	Stuffing not included
Wonton	9~10	50	1	
Fried Bread Stick	Unit	50	1	
Fried Dough Cake	Unit	70~80	1.4~1.6	Flour 35g, Red Bean 15g
Fried Cake	Unit	50	1	
Sweet Dumpling	3	50	1	
Baked Roll	Unit	50	1	
Sausage	1	27	0.5	
Fried Vegetables	11-inch plate	500	10	Raw Weight
Milk	Standard Glass	250	5	Not beverage
Yoghourt	Standard Glass	250	5	Not beverage
Milk Powder	Standard Spoon	10	0.2	
Eggs	1	60	1.2	
Duck Eggs	1	70	1.4	
Quail Eggs	5	50	1	
	Standard Bowl (Small)	250	5	

Soybean Curd & Milk	Standard Bowl (Large)	300	6
Beer	Standard Glass	250	5
Peanut	Standard Bowl (Small)	120	2.4
Peeled peanut	Standard Bowl (Small)	200	4
Chestnuts	10	50	1

(Chinese Nutrition Society, 2001)

Based on the reference table and the weighting method, our group acquired individual food consumptions of all respondents. The investigation also measured the height, weight and blood pressure of samples.

Sample choice:

Samples were randomly chosen from Jiangnan University, Langgao Nursing Home, and the Xinjie Community. The sample number is 147, male 68, female 79, with age varies from 18 to 76.

Statistical Methodology:

When the original data were collected and corrected, the data should be input into the dietetic statistic model. The food intake, nutrition intake, the heat supply ratio of the three major nutrition, and the heat distribution of the three meals should then be calculated. Raw data will then be analyzed using **SPSS 11.0** (Statistical Product and Service Solutions). The software was chosen because of its solution statistical package for the social science can help us analyze the data collected. (Norusis, 1992)

Raw Data

After the raw data is collected, we input the data into the SPSS software. When the result is generated, we then compare the result with the Dietary Reference Intakes. The result is as shown below:

Chart 1: Compare the daily nutrient intakes with the Diet Pagoda		
Nutrient Type	Intake (g/d)	Recommended Intake (g/d)
Oil and Fat	53.8	25
Milk and Milk Products	50.6	100
Beans and Bean Products	36.3	50
Livestock and Poultry	125.4	50~100
Fish and Shrimp	61.4	50
Eggs	40.9	25~50
Vegetables	287.6	400~500
Fruits	112.5	100~200
Cereals	305.4	300~500
Salt	14.7	6
Soy	11.0	N/A
Sugar	8.0	N/A

Chart 2: Intake of Energy and Nutrients			
Nutrient	Intake	DRIs (RNI)	DRIs%
Energy (MJ)	7.86	10.03	78.3
Protein (g)	77.50	75.00	103.3
Fat (g)	92.20	N/A	N/A
Carbohydrate (g)	173.70	N/A	N/A
Vitamin A (µgRE)	539.90	800.00	67.5
Vitamin B1 (mg)	1.30	1.40	92.9

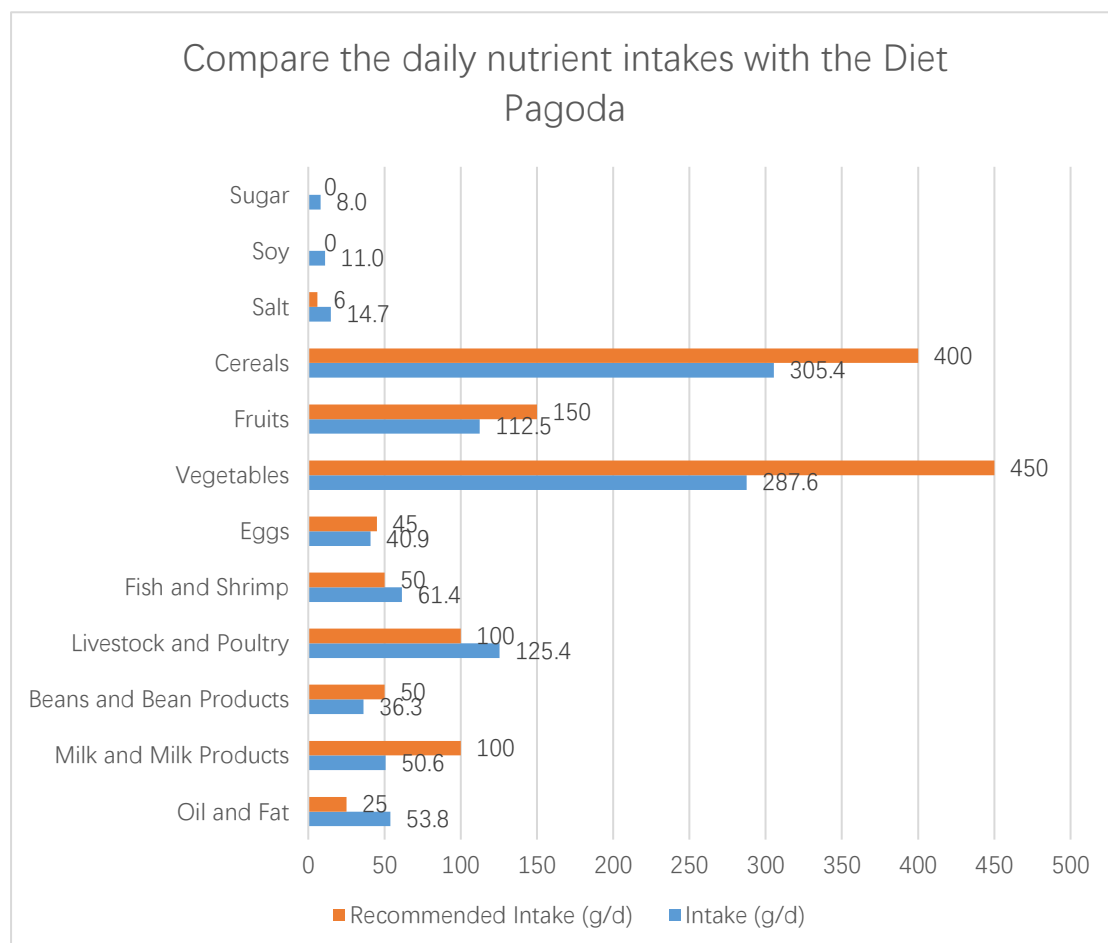
Vitamin B2 (mg)	0.80	1.40	57.1
Niacin (mg)	13.30	14.00	95.0
Vitamin C (mg)	75.80	100.00	75.8
Calcium (mg)	478.90	800.00	59.9
Iron (mg)	24.00	15.00	160.0
Selenium (mg)	47.50	50.00	95.0

Chart 3: The energy distribution of three meals				
Energy Type	Intake (g)	Energy (kJ)	Total energy %	Recom ratio %
Protein	77.5	1298.4	16.9	10~15
Lipid	92.2	3493.0	45.3	20~30
Carbohydrate	173.7	2911.6	37.8	55~70

Result and Analysis

Based on above data collected, our group processed the result into cluster bar chart for clearer demonstration. The chart make it easier to see the difference between the actual intake of Wuxi citizens and the Dietary Reference Intakes. We then analyzed based upon it.

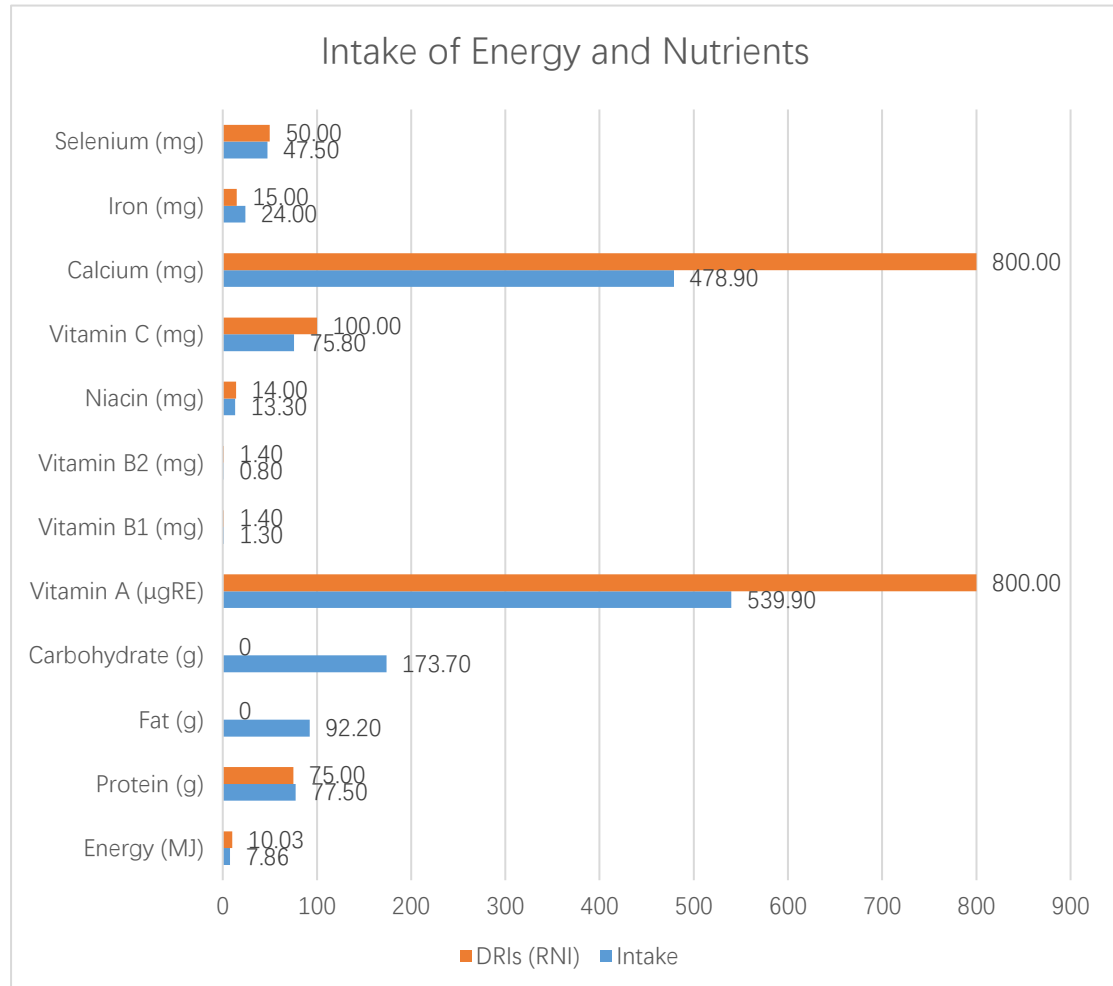
Compare the daily food intakes with the Diet Pagoda



As shown from the result, Wuxi citizens are over-consuming Livestock and Poultry, Oil and Fat. The intake of Livestock and Poultry is 1.3 times the recommended intake, the intake of oil and fat is 2.2 times the recommended intake. There is under-consumption of milk, milk products, beans, and bean products, 50.6% and 72.6% of the recommended intake. Also the intake of

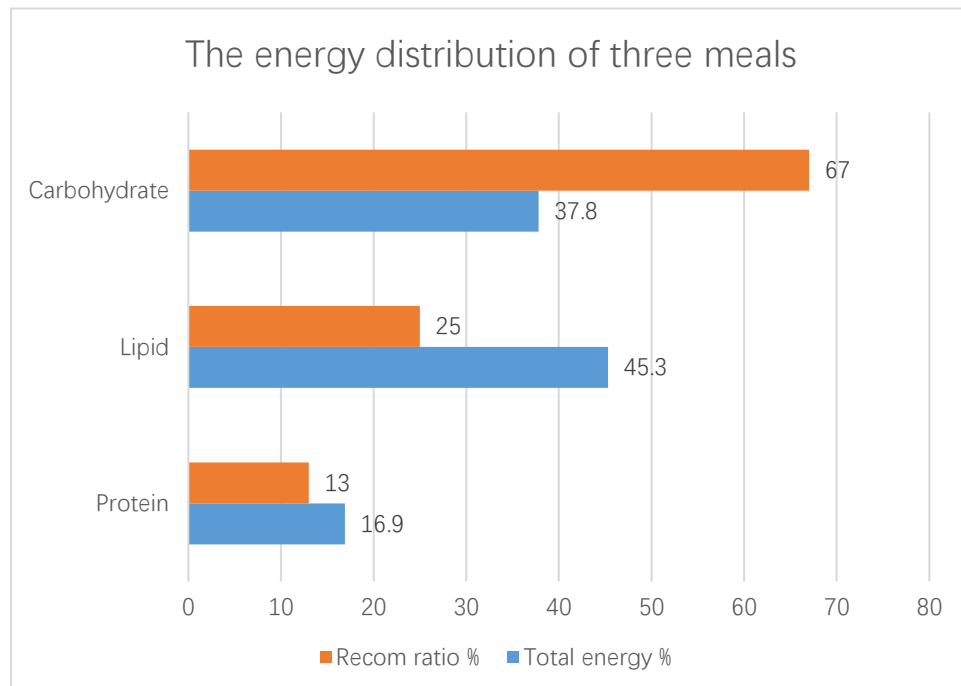
cereals and vegetables have reached the minimum of the recommended intake.

Intake of energy and nutrients



As shown in Chart 2, the average energy intake is 78.3% of the recommended (RNI). The intake of protein has reached the requirement, to 103.3% of RNI. High quality protein counts as 57.8% of the total protein intake, in which 51% were from animal protein while 5.2% were from legume (beans) protein; other protein resources count as 42.2%. The intake of various vitamins is obviously insufficient, especially vitamin A, B2, C, count as 67.5%, 57.1%, 78.8% of the RNI intakes. The intake of calcium is severely insufficient, counts as only 59.9% of the RNI intake.

The heating ratio of the three major nutrients and the energy distribution of three meals



Among all energy resources, lipid provide 45.3% of heat, greater than the recommended ratio of 20%~30%. The energy provided by carbohydrate is only 37.8%, way smaller than what WHO recommended to be 55%~70%. The heat distribution of Wuxi citizens' three meals is: breakfast 20.4%, lunch 38.2%, dinner 41.4%.

Hypertension and obesity

Among all respondents, 34 of them have hypertension, count as 23.1% of the total sample population. According to the Food and agriculture organization of the united nations, body mass index (BMI) is a value derived from the weight and height, attempt to quantify the nutritional status. BMI < 18.5 is categorized as chronic malnutrition; BMI around 18.5~25 is categorized as normal, BMI > 25 is categorized as obese. The survey showed that, 31 respondents are obese, count as 21.2% of the total population. 19 respondents are chronic malnutritional, count as 12.9% of the total population.

Discussion and Suggestions

Analysis on the heat ratio and energy distribution of three meals

A good diet should have protein provides 10%~15% of the heat, lipid provide 20%~30% of the heat, and carbohydrate provide 55%~70% of the heat. As shown in chart 3, protein and lipid provide too much heat while carbohydrate is not enough. This has to do with Wuxi citizens' under-consumption of grains, fruits, vegetables, milk products, bean products; and over-consumption of livestock, poultry, and lipid products. As many researches have suggested, diseases such as obesity, diabetes, and dyslipidemia is strongly correlated with high fat diet.

Our suggestion to Wuxi citizens is that we should eat more grains and tuber crops to increase the intake of carbohydrate. Citizens should have more milk and bean products, eat less livestock or poultry to decrease the heat ratio of lipid products. The recommended heat distribution is breakfast 30%, lunch 40%, dinner 30%. The survey showed that Wuxi citizens' breakfast heat ratio is low at 20.4%, while the dinner heat ratio is high at 41.4%. The over-intake of heat at night is not conducive to sleep, and the excess heat energy can easily be turned into fat and causes obesity.

Vitamin and minerals

Vitamin B2 is a vital component in the body involved in both metabolism and energy metabolism. Lack of such component may reduce the body's antioxidant ability, increase its sensitivity to carcinogens, and interfere the absorption, storage or mobilization of iron. Severe cases can cause iron deficiency anemia.

Our survey suggested that Wuxi citizens' Vitamin B2 intake is only 57.1% as recommended (RNI). This might be caused by Wuxi citizens' under-consumption of grains. Therefore, our group suggest local people to eat more coarse grains and fresh vegetables. Calcium has a positive therapeutic effect in the prevention and treatment of osteoporosis and hypertension. (Cutler, 1990) In the survey, our group found that Wuxi residents are severely lacking the intake of calcium (478.9mg), which is only 59.9% of the recommended intake (RNI). This is related to Wuxi residents' under-consumption of milk and bean products, thus we recommend local people to increase the intake of this kind of food.

Obesity and hypertension

Among the 147 respondents in the survey, 21.1% of them were suffering from obesity in various degrees. This phenomenon is consistent with over-consumption of livestock and fat we found in the survey. Also, the survey showed that 23.1% of the population is suffering from hypertension. Therefore, our group recommend Wuxi government to enhance health education, increase the public awareness of early dietary intervention and active hypertension treatment. This might be helpful to not only the prevention of hypertension, but also has its own significance in the prevention of coronary heart disease and diabetes.

Conclusion

From what has been discussed above, Wuxi citizens' dietary structure still have many potential ways to make improvement. Our group highly recommend Wuxi residents to have more grains, tuber crops, fruits, and vegetables to increase the intake of carbohydrate, vitamins, and minerals; have more milk, milk products, beans, bean products to increase the intake of calcium; control the intake of food with high fat and high cholesterol.

Also, our group is recommending local government and other non-profit organizations to carry out dietary education, advertising the Chinese citizens' Dietary Reference Intakes, Chinese citizens' Dietary Guidelines and Balance Diet Pagoda through multiple medias. Our group is also working on a new-media platform to advocate balanced diet and healthy life-style. To keep pace with the rapid urban development, we should all put effort in preventing the rising incidence of chronic diseases and the continuous decline of health conditions.

Bibliography

Various, By. "years. China Statistical Yearbook (1991–2006). National Bureau of Statistics of." (2010).

Fengying, Zhai. "To build the well-off society, nutritional legislation must be made." *Journal of Nutrition* 27.1(2005):1-4.

Fang, Mei. "On the Position of Dialectics of Nature in Science System." *Journal of Anhui University of Technology* (2001).

Tu, Y. "The discovery of artemisinin (qinghaosu) and gifts from Chinese medicine. " *Nature Medicine* 17.10(2011):1217-1220.

Yates, Allison A., S. A. Schlicker, and C. W. Sutor. "Dietary Reference Intakes." *Nutrition Reviews* 98.6(1998):699-706.

Murphy, S. P., and S. I. Barr. "Practice paper of the American Dietetic Association: using the Dietary Reference Intakes. " *Journal of the American Dietetic Association* 111.5(2011):762-70.

Yanping, Li. "Comparison between weighting method, review method and food frequency method on assessing food intake" *Chinese Journal of Preventative Medicine* 40.4 (2006) : 273-280.

Chinese Nutrition Society. "Dietary Reference Intakes for Chinese people." *Acta Nutrimenta Sinica* 23.3 (2001) : 193-196.

Norusis, Marija J. *SPSS for Windows: Base System User's Guide, Release 5.0*. SPSS Incorporated, 1992.

Cutler, J. A., and E. Brittain. "Calcium and blood pressure. An epidemiologic perspective. " *American Journal of Hypertension* 3.8_Pt_2(1990):137S.