New Era’s Health Challenges and Nutrition Opportunities in China

Wenhua Ling, MD, Ph.D
Outline

I. Nutrition Status and Nutrition Problems in China

II. Chinese dietary reference intakes
   • Nutrients
   • Non-nutrients and phytochemicals

III. Nutrition and chronic metabolic diseases
   • Cohort studies
   • Achievements
I. Nutrition Status and Nutrition Problems in China from 1982-2012


- Food Consumption
- Nutrient Intake
- Nutrition Problems
- Nutrition related health problems
Study population of nutrition survey of 2010-2012

- Participants 210,000 people.
- A total of 31 provinces, autonomies, cities.
- Urban: Metropolis, moderate, and small cities.
- Rural: Ordinary and poor areas.
A total of 150 surveillance spots: 34 metropolis (★), 41 moderate and small cities (●), 45 ordinary rural areas (▼) and 30 poor rural areas □
Cereal and vegetable intake

1. Cereal consumption

- Urban: 459.0, 366.0, 281.7, 336.8
- Rural: 406.7, 416.1, 392.2

2. Vegetable consumption

- Urban: 531.0, 483.8, 416.1, 392.2
- Rural: 486.7, 450.0, 416.1, 392.2

The average cereal consumption

The average vegetable consumption
3. Meat consumption

4. Milk consumption

- It is very imbalance between urban residents and rural residents.
5. Egg and egg product consumption

6. Oil consumption
## 7. Salt consumption

<table>
<thead>
<tr>
<th>Year</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>11.4</td>
<td>13.3</td>
</tr>
<tr>
<td>1992</td>
<td>10.9</td>
<td>10.3</td>
</tr>
<tr>
<td>2002</td>
<td>13.2</td>
<td>13.9</td>
</tr>
<tr>
<td>2010-2012</td>
<td>12.4</td>
<td>10.7</td>
</tr>
</tbody>
</table>

The chart above illustrates the salt consumption (g) for urban and rural areas from 1982 to 2010-2012.
Energy and nutrient intake
The average energy intake is 2134.8 kcal per reference man per day, accounting for 94% of the Reference Nutrient Intake.
The average protein intake was 64.6 g in 2012.
The difference between urban and rural areas was 1.7g in 2012.

The average fat intake was 75.4g in 2012.
The intake of urban residents was 12.7g more than that of rural residents in 2012.
Dietary fat provided 31.5% of energy intake.

In the urban area it provided 35.5% of energy intake, that exceed the reference value (30%).
<table>
<thead>
<tr>
<th>vitamin</th>
<th>Urban</th>
<th>Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinol (RE/d)</td>
<td>103.9</td>
<td>277.0</td>
<td>223.6</td>
</tr>
<tr>
<td>retinol Equivalent (RE/d)</td>
<td>147.3</td>
<td>605.5</td>
<td>547.2</td>
</tr>
<tr>
<td>Thiamine (mg/d)</td>
<td>2.1</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Riboflavin (mg/d)</td>
<td>0.8</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Ascorbic acid (mg/d)</td>
<td>109.0</td>
<td>95.6</td>
<td>82.2</td>
</tr>
</tbody>
</table>

- Thiamine and ascorbic acid intake was 0.9 mg and 80.5 mg. The intake of Thiamine and ascorbic acid has continuously dropped since 1982.
- The riboflavin intake has not been changed much in these years. The average intake was 0.8 mg, accounting for 62.9% of the RNI.
Minerals---Iron

Compared with RNI in China, the intake of calcium are far below and almost equals to half of RNI.
Nutrition-related health problems
Compared to the survey of 2002, the prevalence of anemia in urban residents reduced by 46.7%, in rural residents reduced by 53.4%.
The prevalence of hypertension among adults was 22.8% in 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hypertension (Prevalence Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>14.5%</td>
</tr>
<tr>
<td>2002</td>
<td>18.8%</td>
</tr>
<tr>
<td>2010-2012</td>
<td>22.8%</td>
</tr>
</tbody>
</table>

The prevalence of diabetes among adults was 6.8% and 14.7% in 2002 and 2012.

- The prevalence of diabetes among adults was 6.8% and 14.7% in 2002 and 2012.
- This means there are more than 80 million diabetic patients in China.
Blood Lipid Abnormality (>18y)

Prevalence Rate (%) by Age Group and Sex:
- **18-44:**
  - Male: 21.2%
  - Female: 38.1%
- **45-59:**
  - Male: 20.5%
  - Female: 40.8%
- **60+:**
  - Male: 21.9%
  - Female: 37.7%

Prevalence Rate (%) by Urban Area and Year:
- **2002:**
  - Urban: 49.4%
  - Large City: 50.0%
  - Small-Medium City: 41.6%
- **2010-2012:**
  - Urban: 49.4%
  - Large City: 50.0%
  - Small-Medium City: 41.6%

Age Group:
- 18-44
- 45-59
- 60+

Sex:
- Male
- Female
Existing Nutrition Problems in China

In large and medium sized cities in China, the number of people with nutrition-related diseases is increasing annually.
II. Chinese dietary reference intakes

Nutrients for DRIs

- We are integrating food and nutrition disciplines in nutrition and food sciences to accelerate the research
- Setting new DRIs
- 2000 Chinese Dietary Reference Intakes
- 2013 Chinese Dietary Reference Intakes
Estimated average requirement (EARs)
Recommended nutrient intake (RNI), equal to RDA
Adequate intake (AIs)
Tolerable Upper Intake level (UL)
Acceptable macro-nutrient distribution ranges (AMDR)
General situation for DRIS of 2013

Set new quantitative value for RNI, AI and UL

- Acceptable macro-nutrient distribution ranges (AMDR)
- Proposed intakes for preventing non-communicable chronic diseases (PI-NCD)

Afford systematical review for the components
<table>
<thead>
<tr>
<th>Category</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Definition, methods, formula, application</td>
</tr>
<tr>
<td>Macronutrient</td>
<td>- E, CHO, Fat, and fat acids: DHA, EPA, n-3</td>
</tr>
<tr>
<td></td>
<td>- Protein</td>
</tr>
<tr>
<td>fat-soluble vitamins</td>
<td>- Vit A, Vit E</td>
</tr>
<tr>
<td></td>
<td>- Vit D, Vit K</td>
</tr>
<tr>
<td>water-soluble vitamins</td>
<td>- Vit B1, B2, B6, B12, Folic acid,</td>
</tr>
<tr>
<td></td>
<td>- Vit C, Niacin, Choline, Biotin, Pantothenic acid</td>
</tr>
<tr>
<td>Trace Elements</td>
<td>- Zinc, Iron, I, se, cobalt</td>
</tr>
<tr>
<td></td>
<td>- Cu, Mn, Mo, Cr, F</td>
</tr>
<tr>
<td>Macro-elements</td>
<td>- Ca, P, Mg, K, Na, chloride</td>
</tr>
<tr>
<td>Non-nutrients</td>
<td>- Water, Fiber</td>
</tr>
<tr>
<td></td>
<td>- 18 Phytochemicals</td>
</tr>
</tbody>
</table>
Non-nutrients and phytochemicals

- Set SPL for bioactive compounds
- Recent experiences in China
What is SPL?

SPL = Specific Proposed Levels

- SPL and UL are a comprehensive set of values for phytochemicals in healthy populations that can be used as a guide for their diet.

- SPL reflect the current scientific knowledge regarding non-nutrients.

- Daily intake up to this level is beneficial to human health.
non-nutrients substances – reviewed list

- water
- Dietary fiber
- FOS
- Anthhoyanin
- Resveratrol
- Catechol
- Quercetin
- Curcumin
- Chlorogenic acid
- Lutin
- Zeaxanthin
- Lycopene
- Proanthocyanidins
- Isoflavones
- Phytosterol
- Isothiocyanates
- Allicin, Garlic,
- Glucosamine
- GABA
- alpha-Lipoic Acid (LA)
- L-carnitine
### Specific Proposed Level (SPL)

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C: data insufficient Informative insufficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting Al 2</td>
<td>Setting SPL 9</td>
<td>L-carnitine</td>
</tr>
<tr>
<td>Water 1.5-1.7L</td>
<td>Soy Isoflavone</td>
<td>Resveratrol</td>
</tr>
<tr>
<td>Fiber 25-30 g</td>
<td>Lutin</td>
<td>r-GABA</td>
</tr>
<tr>
<td></td>
<td>Lycopene</td>
<td>curcumin</td>
</tr>
<tr>
<td></td>
<td>phytosterol</td>
<td>Allicin</td>
</tr>
<tr>
<td></td>
<td>Glucosamine</td>
<td>Chlorogenic acid</td>
</tr>
<tr>
<td></td>
<td>Anthocyanin</td>
<td>alpha-Lipoic Acid</td>
</tr>
<tr>
<td></td>
<td>Quercetin</td>
<td>catechins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Isothiocyanates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proanthocyanin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FOS</td>
</tr>
</tbody>
</table>
## UL: recommended

<table>
<thead>
<tr>
<th>Group A: 5</th>
<th>Group B: 9 UL</th>
<th>Group C: 5 Informative insufficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not necessary.</td>
<td>Xanthophylls 40mg/d</td>
<td>Allicin</td>
</tr>
<tr>
<td>Water catechins</td>
<td>Lycopene 70mg/d</td>
<td>Glucosamine</td>
</tr>
<tr>
<td>r-GABA</td>
<td>Lipoic acid 600mg/d</td>
<td>DF</td>
</tr>
<tr>
<td>anthocyanin</td>
<td>Curcumin 180mg/d</td>
<td>Isothiocyanates</td>
</tr>
<tr>
<td>Taurine</td>
<td>Resveratrol 2.5g/d</td>
<td>Quercetin</td>
</tr>
<tr>
<td></td>
<td>Proanthocyanin 800mg/d</td>
<td>Fructoligosaccharide</td>
</tr>
<tr>
<td></td>
<td>Phytosterol 2.4g-3.9g/d</td>
<td>Chlorogenic acid</td>
</tr>
<tr>
<td></td>
<td>Soy Isoflavones 120mg/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L- carnitine 75mg/d</td>
<td></td>
</tr>
</tbody>
</table>
III. Nutrition and chronic metabolic diseases in China

Prospective cohort study

• Nutrients related risk factor of chronic diseases

• Provide adequate food, dietary pattern, nutrients.
<table>
<thead>
<tr>
<th>Cohort name</th>
<th>Subjects</th>
<th>Period</th>
<th>Principal Investigator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese chronic disease cohort</td>
<td>500,000 subjects</td>
<td>from 2010-present</td>
<td>Li, liming</td>
</tr>
<tr>
<td>Jiaxing Birth Cohort</td>
<td>42,550 children</td>
<td>from 1993-present</td>
<td>Li, Duo</td>
</tr>
<tr>
<td>CHD patient cohort</td>
<td>5,000 patients</td>
<td>from 2008-present</td>
<td>Ling, Wenhua</td>
</tr>
<tr>
<td>The Harbin Cohort Study on Diet, Nutrition and Chronic Non-communicable Diseases</td>
<td>9734 people</td>
<td></td>
<td>Sun, Changhao</td>
</tr>
</tbody>
</table>
Food and nutrients affect chronic diseases

Diets and Nutrients Phytochemicals

- Animals
- Human trials
- In vitro

Chronic diseases

Effects and mechanisms
Food and Nutrients affect chronic diseases

Biology
- age
- gender
- gene

Social and Environments
- Physical
- Smoke
- diet

Biomarkers
- Inflammation
- Oxidative stress
- Dyslipidemia
- Abnormal glucose metabolism
- Mutated genes

Clinical outcomes
- CHD
- Hypertension
- Diabetes
- Obesity
- Cancers
Publications


Proposed collaboration

• Nutrition and Chronic Diseases epidemiology, interventional trials
• Phytochemicals and health chronic diseases prevention bioavailability health products
谢谢各位！
Basic principles for setting DRIs of 2013

- Evidence based nutrition
- Systematical review and meta-analysis
- Randomized controlled trial, RCT
- Cohort study
- Case-control study
- Views from experts
- Basic experiments