Adaptive and Personalized Nutrition: Opportunities & Challenges in Brazil

Thomas Ong, PhD, Assist. Prof

tong@usp.br

Faculty of Pharmaceutical Sciences

Food Research Center

UNIVERSITY OF SÃO PAULO/BRAZIL
Retrato de Mulher. Benedito José Tobias
Imigrantes. Antonio Rocco, 1910
<table>
<thead>
<tr>
<th></th>
<th>1960</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (million)</td>
<td>71</td>
<td>191</td>
</tr>
<tr>
<td>GDP per head (US$)</td>
<td>1448</td>
<td>4448</td>
</tr>
<tr>
<td>Urbanisation (%)</td>
<td>45</td>
<td>86</td>
</tr>
<tr>
<td>Adult literacy (%)</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Total fertility rate (children/woman)</td>
<td>6.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>
Operários.
Tarsila do Amaral
November, 2009

Getting it together at last
A special report on business and finance in Brazil
November 14th 2009

July, 2010

Brazil takes off
The decline of music piracy
Nigeria gets better
Farmers v greens in America
How drugs are being decriminalised
Bland bosses
Chronic non-communicable diseases in Brazil: burden and current challenges

Maria Inês Schmidt, Bruce Bartholow Duncan, Gulnar Azevedo e Silva, Ana Maria Menezes, Carlos Augusto Monteiro, Sandhi Maria Barreto, Dora Chor, Paulo Rossi Menezes

Non-communicable diseases (NCDs) have become a major health priority in Brazil—72% of all deaths were attributable.
<table>
<thead>
<tr>
<th>Diseases and health problems that need special attention</th>
<th>Frequency and trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health of mothers and children</td>
<td></td>
</tr>
<tr>
<td>Illegal abortions</td>
<td>Highly prevalent</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td></td>
</tr>
<tr>
<td>Dengue fever</td>
<td>Repeated epidemics</td>
</tr>
<tr>
<td>Non-communicable diseases</td>
<td></td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>Rapid increase</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Increasing</td>
</tr>
<tr>
<td>Hypertension</td>
<td>High prevalence, still increasing</td>
</tr>
<tr>
<td>Cancer</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Non Communicable Diseases as major health problems in Brazil

- 2007 - 72% deaths of all deaths
- Prevalence is greater among the poorest and less privileged ethnic groups
Figure 1: Recent trends in NCD mortality for 1996 to 2000 and 2007
Non Communicable Diseases as major health problems in Brazil

- Greater income
- Mechanisation/Industrialization
- Improved access to food
- Globalisation of unhealthy habits

NUTRITIONAL TRANSITION

“Os retirantes”. Cândido Portinari
Dietary Guidelines for Brazilians (DGB)

- 1950s First official nutritional program
  *goiter*

- 1970s Guidelines and small programs
  *overall nutritional deficiencies*

- 1990s Chronic diseases
Dietary Guidelines for Brazilians (DGB)

- 2006
- Scientific committees – Ministry of Health
- WHO, USDA guidelines + local aspects
- No specific visual aid
- Folders, banners, pocket edition
  - non-academic language
  - graphically attractive
Principles underlying the DGB

- Integrated approaching
- Scientific basis plus culture
- The food is the reference
- Environmental sustainability
Dietary Guidelines for Brazilians (DGB)

- Fruits and vegetables (3 portions each) 400g
- Cereals and roots: complex carbohydrates, 6 portions
- Beans: one portion daily; rice (2): beans (1)
- Fats: vegetable, olive oil; saturated fat (10% total energy)
- Sugar: 10% total energy
- Physical activity: at least 30 minutes/daily
How is your diet?

This test is about your food.

1. How many pieces of fruit do you eat, or how many glasses of natural fruit juice do you drink a day?
   - I do not eat fruit and don’t drink any natural fruit juice ☐
   - 1 ☐
   - 2 ☐
   - 3 ☐
   - 4 or more ☐

2. How many tablespoons of vegetables do you eat a day?
   - I do not eat vegetables ☐
   - 1 to 4 tablespoons ☐
   - 5 to 8 tablespoons ☐
   - 9 or more tablespoons ☐

3. How many times a week do you eat one of these foods: beans, lentils, peas, chick peas or Lima beans?
   - I never ☐
   - 1 time ☐
   - 2 times ☐
   - 3 times ☐

4. How many tablespoons of rice, flour, or pasta do you eat a day?
   - I never ☐
   - 1 to 5 tablespoons ☐
   - 6 to 10 tablespoons ☐
   - 11 or more tablespoons ☐

5. How many pieces of beef, pork, poultry, fish or eggs do you eat daily?
   - 10 to 1 piece or 1 egg ☐
   - 2 pieces or 2 eggs ☐
   - More than 2 pieces or more than 2 eggs ☐

Choose only ONE answer. Let’s start!
10 steps for a healthy diet.

We are going to present to you the 10 steps for a healthy diet. These steps may and should be followed by the whole family. You have already answered the test about your diet and already know the week points that need to be improved. Choose the one that would be the most useful for you and try to follow it every day. In the case that one day you are not able, don’t give up. Try again the next day. When the step becomes part of your daily routine, then begin trying the next step.

1. Make at least 3 meals and a snack a day.
   Don’t skip meals.
   For a snack and dessert prefer fruit. Having your full meals, you avoid the stomach to be empty for long and reduce the risk of gastritis, and also the exaggeration on the quantity you eat. Avoid taste, that will not help you control your weight.

2. Eat breads at least once a day, and a minimum of 4 days a week.
   Breads are rich in iron. At meal time put a table of breads on the plate, so as to avoid anemia.

3. Reduce fat foods, such as meats with visible fat, hot dogs, cold cuts, fried foods and salty snacks, to a stick a week.
   Remember before cutting the skin of the chickens, the visible fat of nose and the skin of the fish.
   Although vegetables are being a healthier type of fat, anything in excess is harmful. The ideal is not to use more than one ounce of vegetable oil per person for a family of 4 people. Choose cooked or baked foods and avoid cooking with margarine, vegetable shortening or butter.

4. Decrease the use of salt.
   Salt is the greatest source of sodium in a diet. Sodium is essential for the body to work, but too much sodium can cause high blood pressure, which can lead to hypertension. The children and the adult don’t need more than a pinch of salt a day. Follow these hints do not place a salt shaker on the table, then you avoid putting something more on the food on the table. Avoid prepared condiments, canned food, fried meat and cold cuts such as salami, ham, sausages and others. All of them are full of salt.

5. Reduce eating sweets, cakes, cookies and other foods rich in sugar to no more than 3 times a week.

6. Reduce the consumption of alcohol and women. Avoid daily use.
   Water is the best drink.

7. Frug your meal.
   Eat slowly.
   Make the meals a family gathering. Don’t eat watching TV.

8. Keep your weight within healthy limits – see your health manual if your body mass index is between 18.5 and 24.9 kg/m².
   The index shows if your weight is adequate for your height. It is figured by dividing the weight, in kilograms, by the height, in meters, squared.

<table>
<thead>
<tr>
<th>Body Mass Index (BMI)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5 - 23.9</td>
<td>normal</td>
</tr>
<tr>
<td>24.0 - 29.9</td>
<td>overweight</td>
</tr>
<tr>
<td>30.0 and up</td>
<td>obesity</td>
</tr>
</tbody>
</table>

9. Be active. Accumulate 30 minutes of physical activities every day. Walk your neighborhood. Climb stairs. Don’t spend many hours watching TV.
Dietary Guidelines for Brazilians (DGB)

- Limitations and Challenges
  - cultural-based icon
  - carbohydrate quality (glycemic index)
  - bioactive food compounds
  - Penetration of BDG???
  - Effectiveness???
“Health Survey for São Paulo” – large cross sectional study

1677 individuals

24 h Dietary Recalls

Maximum recommended daily intake (WCRF) = 71.4 g
Table 1: Usual red and processed meat intake (g/d) according to sex and socio-economic variables: Brazilian adults (n 1677) aged ≥19 years, São Paulo, 2003

<table>
<thead>
<tr>
<th>variable</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>347</td>
<td>143</td>
</tr>
<tr>
<td>Elderly</td>
<td>395</td>
<td>105</td>
</tr>
<tr>
<td>Education of household head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤7 years</td>
<td>436</td>
<td>135</td>
</tr>
<tr>
<td>≥8 years</td>
<td>298</td>
<td>142</td>
</tr>
<tr>
<td>Family income per capita</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low income</td>
<td>202</td>
<td>131</td>
</tr>
<tr>
<td>Middle income</td>
<td>226</td>
<td>141</td>
</tr>
<tr>
<td>High income</td>
<td>254</td>
<td>139</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>331</td>
<td>138</td>
</tr>
<tr>
<td>Smoker and ex</td>
<td>390</td>
<td>136</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not drink for 1 year</td>
<td>299</td>
<td>133</td>
</tr>
<tr>
<td>Drinks at least twice a month</td>
<td>419</td>
<td>139</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>482</td>
<td>135</td>
</tr>
<tr>
<td>Other</td>
<td>258</td>
<td>143</td>
</tr>
<tr>
<td>Total</td>
<td>742</td>
<td>138</td>
</tr>
</tbody>
</table>

*P value for F statistic (lincom test).
Read meat consumption in São Paulo

- Consumed almost universally in the City of São Paulo
- Excessive consumption for males
- Consumption was greater when compared to the US
- How to stimulate consumption reduction?
Benzo[a]pyrene (Bp)

Glutathione S-transferase

Bp/glutathione

Bp/glutatione

Colon cell

MUTATION
Jabuticaba

Camu-Camu

Pindaíba
Chemical composition and antioxidant potential of Brazilian native fruits

Gonçalves et al. J Agric Food Comp, 58:4666-74, 2010
Camu-Camu

- Quercitin
- Ellagic acid
- Cyanidin

Cambuci

- Quercitin
- Ellagic acid
Effects of Maté tea consumption in healthy young women

- 15 healthy young women
- 5g/500 mL maté tea/day – 1 week
- Oxidative stress markers in plasma
- Expression of antioxidant genes in blood cells
### Table 3. Lag Time, TBARs, and Total Antioxidant Status of Plasma from Subjects at the Baseline (T₀) and after Acute (One Hour - T₁) and Prolonged (One Week - T₂) Ingestion of Instant Maté Tea

<table>
<thead>
<tr>
<th>period</th>
<th>lag time (min)ᵃ</th>
<th>TBARS (µmol/L)ᵃ</th>
<th>TAS (mmol/L)ᵃ</th>
</tr>
</thead>
<tbody>
<tr>
<td>baseline (T₀)</td>
<td>12.46 ± 7.58</td>
<td>4.32 ± 1.15</td>
<td>0.92 ± 0.10</td>
</tr>
<tr>
<td>one hour (T₁)</td>
<td>21.15 ± 11.46ᵇ</td>
<td>3.60 ± 1.15ᶜ</td>
<td>0.91 ± 0.11</td>
</tr>
<tr>
<td>one week (T₂)</td>
<td>23.90 ± 20.3ᵇ</td>
<td>2.73 ± 0.65ᶜ</td>
<td>0.97 ± 0.09ᶜ</td>
</tr>
</tbody>
</table>

ᵃ Values are expressed as the mean ± SD (n = 15). ᵇ p < 0.05 compared to T₀. ᵇ p < 0.001 compared to T₀.
Effects of Maté tea consumption in healthy young women
Effects of Brazil nuts consumption in obese women

- 37 morbidly obese women
- 1 nut/day 8 weeks
- 290 micrograms selenium
- GPX1 PRO198LEU

Effects of Brazil nuts consumption in obese women

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th></th>
<th>After supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pro/Pro (n = 18)</td>
<td>Pro/Leu (n = 14)</td>
</tr>
<tr>
<td>Plasma Se (µg/L)</td>
<td>54.0 ± 12.1</td>
<td>55.2 ± 14.0</td>
<td>62.7 ± 16.0</td>
</tr>
<tr>
<td>Erythrocyte Se (µg/L)</td>
<td>60.8 ± 18.5</td>
<td>65.0 ± 37.6</td>
<td>59.7 ± 23.1</td>
</tr>
<tr>
<td>Erythrocyte GPx (U/g Hb)</td>
<td>38.5 ± 18.0</td>
<td>33.0 ± 12.4</td>
<td>31.4 ± 19.6</td>
</tr>
<tr>
<td>Comet length (µm)</td>
<td>80.8 ± 18.5</td>
<td>67.6 ± 24.3</td>
<td>92.1 ± 12.8</td>
</tr>
</tbody>
</table>

*Comminetti et al. Nutrition, 27:891-6, 2011*
Nutrição no pós-genoma: fundamentos e aplicações de ferramentas ômicas

Nutrition in the post-genome era: ‘omic’ tools basics and applications

Eliane FIALHO
Fernando Salvador MORENO
Thomas Prates ONG

A ciência da nutrição em trânsito: da nutrição e dietética à nutrigenômica

The science of nutrition in transit: from nutrition and dietetics to nutrigenomics

Francisco de Assis Guedes de VASCONCELOS
Rev. Nutr., Campinas, 23(6):935-945, nov./dez., 2010
Self-reported skin color, genomic ancestry and the distribution of \textit{GST} polymorphisms

Guilherme Suarez-Kurtz\textsuperscript{a}, Daniela D. Vargens\textsuperscript{a}, Claudio J. Struchiner\textsuperscript{b}, Luciana Bastos-Rodrigues\textsuperscript{c} and Sergio D.J. Pena\textsuperscript{c}
A DIETA IDEAL

A ciência investiga como cada pessoa reage aos alimentos e como eles influenciam sua nutrição. E caminha para montar dietas personalizadas que irão mudar seu jeito de comer.
Exame de DNA indica como evitar problemas na pele

Padrão genético mostra propensão de cada um e é base para prescrição de tratamento

A palma impressa e a correta rítmica, a iluminação de seu corpo, as mãos e o seu olhar, são elementos que fazem parte do exame de DNA. O DNA, porém, é apenas um componente.

O exame de DNA é uma ferramenta fundamental para identificar a propensão de cada indivíduo a desenvolver determinadas doenças. Os dados obtidos podem ser usados para orientar a escolha de tratamentos eficazes e prevenção.

O exame de DNA pode auxiliar na tomada de decisões sobre a saúde. Ele pode ser utilizado para identificar a propensão a doenças geneticamente determinadas, como o câncer, doenças cardíacas e doenças neurológicas. Além disso, o exame pode ser usado para monitorar a progressão da doença e avaliar a eficácia dos tratamentos.

O que exame identifica

- Cancer
- Alcoolismo
- Doenças renais
- Doenças cardíacas
- Doenças neurodegerativas

Como evitar

- Envolvimento precoce da pele
- Controle e monitoramento regular
- Intervenção precoce

Resultado do exame identifica o risco de cada paciente e facilita na prevenção de danos à pele.

Cada problema tem um tratamento, mas não devemos esquecer que o principal é a prevenção. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

A pesquisa genética é uma ferramenta poderosa para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar o risco de desenvolver doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.

O exame de DNA é uma ferramenta útil para identificar a propensão a doenças geneticamente determinadas. Com o exame de DNA, podemos identificar os riscos de doenças genéticas e tomar medidas preventivas adequadas.
Challenges for personalized nutrition in Brazil

- Capacity building for Nutrigenomics research
  - Scientific training at undergraduate and graduate levels
  - Integrative research
  - National and international collaboration
  - Funding
3. Research topics

This call invites joint research proposals within the following research topics:

- Nutrigenomics
- Source of bioactive compounds, alternative ingredients and biological non-food products from waste residues
- Healthy and sustainable food products, with retained nutritional values, produced from emerging new technologies
- Epidemiological studies related to the consumption of food and prevention of diseases
- Research of the impact of new dietary habits and public recommendations
Organizer: www.isnnbrazil.org.br

Co-Organizers:

International Society of Nutrigenetics / Nutrigenomics

USP

SBAN
Challenges for personalized nutrition in Brazil

- Health professionals – nutrigenomics education
  - Nutrigenomics in health curricula
  - Continuous education
  - Who is going to teach?
  - Graduate Programs in Nutrition/Genetics/Molecular Biology
Challenges for personalized nutrition in Brazil

• Regulatory perspective - ANVISA
  - Legislation
  - Consumer protection
  - Genetic testing
Challenges for personalized nutrition in Brazil

- The consumer?
- Proactive
- Access
- Private or public health system