GOLDEN RICE:
Health Issues and Concerns

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Health Alliance for Democracy (HEAD) and RESIST!
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Vitamin A

- Vitamin A is a **fat-soluble vitamin** and is absorbed and **transported with lipids**
- Vitamin A is **stored in the liver**: recorded cases of toxicity in excess consumption of polar bear liver by Arctic explorers
Vitamin A

- A major role of vitamin A is as part of the visual pigment rhodopsin
- Gene expression
- Maintenance of epithelial tissue
- Regulation of cell growth and differentiation
The problem: Vitamin A deficiency (VAD), which can be life-threatening

WHO: about 124 million children affected; 250,000-500,000 children go blind every year, about half die within 12 months

Vitamin A Deficiency (VAD)

- Dry, hard skin
- Dry cornea and eventual blindness (Xerophthalmia)
- Night blindness (insufficient retinal for rhodopsin formation)
- Impaired immune function
Vitamin A Toxicity

- **Toxic levels** by excess consumption of supplements of pre-formed vitamin A

- **Signs and symptoms** of toxicity
  - Diarrhea, bulging fontanelles
  - Nausea, vomiting, poor appetite
  - Headache, blurred vision, dermatitis
  - Liver and spleen enlargement
  - Lack of muscle coordination
  - Bone abnormalities, congenital defects, cancer
Golden Rice: Hi-tech Solution

- Is Vitamin A deficiency still a significant problem in the Philippines?
- Is Vitamin A deficiency a condition that requires pharmacotherapy (drugs)?
- Is golden rice food or a drug?
- Are there better alternatives to golden rice?
Is Vitamin A deficiency still a problem?

Trends in the prevalence of vitamin A deficiency (VAD) among children, 6 mos – 5 yrs

- 1993: 35.3%
- 1998: 38.0%
- 2003: 40.1%
- 2008: 15.2%
Is Vitamin A deficiency still a problem?


- Pregnant
- Lactating
Is Vitamin A deficiency still a problem?


<table>
<thead>
<tr>
<th>Age/Physiologic State</th>
<th>No. of Participants</th>
<th>VAD (%)</th>
<th>Decrease 1998 vs 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children, 6 mos-5y</td>
<td>14,291</td>
<td>38.0</td>
<td>15.2</td>
</tr>
<tr>
<td>Pregnant</td>
<td>2,963</td>
<td>22.2</td>
<td>9.5</td>
</tr>
<tr>
<td>Lactating</td>
<td>3,165</td>
<td>16.5</td>
<td>6.4</td>
</tr>
</tbody>
</table>

**Significant at 0.01**
According to WHO, tried and tested remedies for VAD have already “averted an estimated 1.25 million deaths since 1998 in 40 countries”
**Does Vitamin A deficiency require drugs?**

### Preventive Supplementation

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Target</th>
<th>Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular or routine clinical</td>
<td>Pregnant women with no signs of</td>
<td>1 cap. of 10,000 I.U. of vitamin A 2x a week to start from 4th month of</td>
</tr>
<tr>
<td>supplementation</td>
<td>xerophthalmia</td>
<td>pregnancy until delivery</td>
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<td></td>
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<tr>
<td>Regular or routine clinical</td>
<td>Lactating women with no signs of</td>
<td>1 cap. -200,000 I.U. of vitamin A within one month after delivery</td>
</tr>
<tr>
<td>supplementation</td>
<td>xerophthalmia</td>
<td></td>
</tr>
</tbody>
</table>

Is golden rice food or a drug?

- Original Golden Rice (GR1): produces only 1.6 μg/gm of carotenoids
  a child would have to eat more than 10 kg/day to get sufficient dose

- In gut, β-carotene (Pro-vitamin A) generates retinal → Vitamin A or retinoic acid (RA)
  RA and its metabolites are toxic and teratogenic
Skin allergies reported by farmers and agriculture workers while working in cotton fields during boll burst stage 2005:

Bt Cotton in India – human allergies

Golden Rice: Problems as a GMO

2007 study by Vavilov's Agrarian University in Russia:
Right mouse: fed with GM soya; Left mouse fed with non-GM soya. GM-soy has impact on the size of the litters and on the mortality of the young.
2005 study by Irina Ermakova:

- Offspring of GM-soy-fed rats die, with growth abnormalities
- Right: 20-day old rat from GM soy-fed study group
  Left: 19-day old rat from non-GM soy fed control group
Are there better alternatives to golden rice?

**FOOD**

- Liver, meat
- Eggs
- Green leafy and deep colored vegetables
- Moringa (malunggay), taro (gabi) leaves, carrots, spinach, sili, kamote, alugbati
- Fruits: mango, papaya, bayabas, duhat
What should be done for Vitamin A deficiency and malnutrition?

- Food diversification/sustainable agriculture
- Long-term strategy that involves the community
- Genuine land reform
- Social determinants of health
Precautionary Principle

“When there are reasonable grounds to indicate potential harm to health and environment, precautionary action should be taken even if cause and effect relationship has not been established scientifically.”
References

- Hansen M. Golden Rice and Bt crops: Unanswered safety and efficacy questions. University of Philippines Los Baños; 24 August 2011
- Food and Nutrition Research Institute. 2008 National Nutrition Survey Results for Vitamin A. 2008
- Quijano R. Health Risks of Genetically Modified Food. August 2011