

WHO Recommendations on Vitamin A Fortification for Wheat and Maize Flour

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Vitamin A Deficiency Disorders

Gradient of Health Consequences

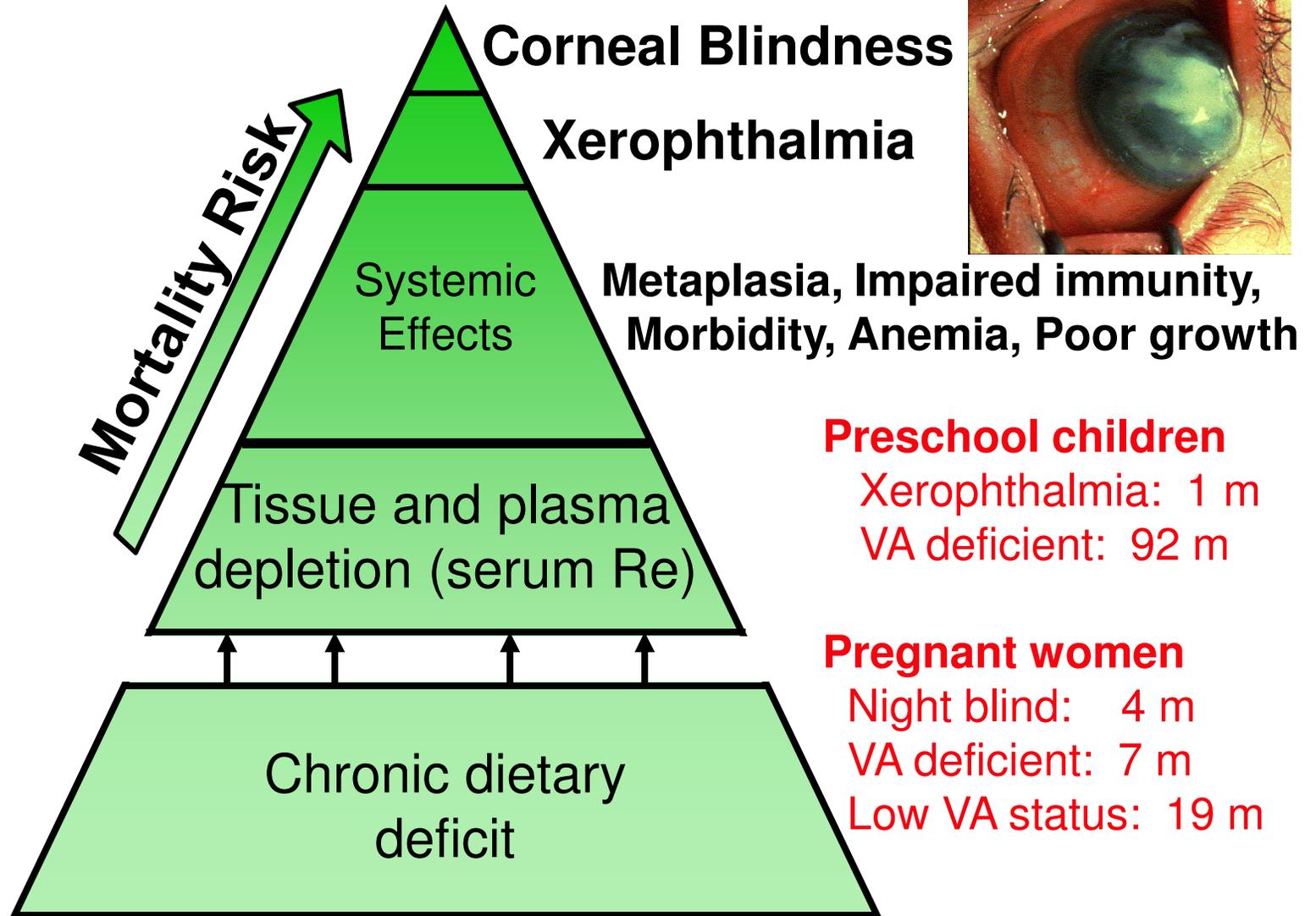




Photo: K West, Jr.

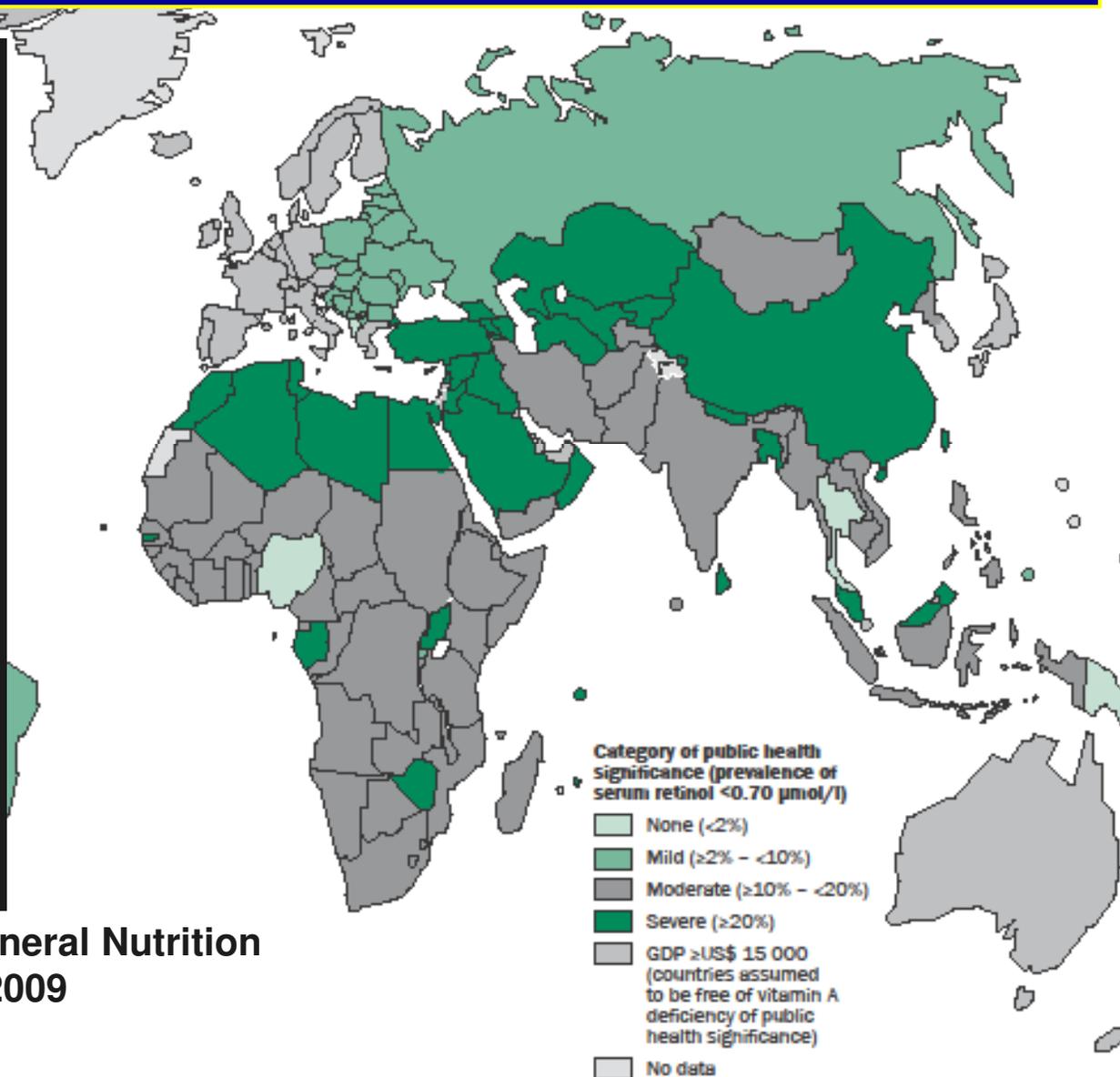
Efficacy of Wheat Fortification with Vitamin A in School Children (6 to ~14 yrs)

	Food Vehicle	ug RAE	% VA- deficient	
			Unfort.	VA Fort.
Philippines (Solon, 2000)	Pandesal (2.8 mg/kg)	133	28.6%	15.3%
Bangladesh (Rahman, 2003)	Chapatti (3.0 mg/kg)	212	22.5%	7.4%



Countries and areas with survey data and regression-based estimates: Pregnant women 1995-2005

- Low serum retinol ($<0.70 \mu\text{mol/L}$) affects 190 million preschool age children and 19 million pregnant women
- 88 countries have a moderate to severe public health problem
- Highest proportion of preschool age children affected are in Africa (44%) and South-East Asia (50%)



Source: WHO Vitamin and Mineral Nutrition Information System VMNIS, 2009

Sources of Vitamin A



Three Vulnerable, Intended Groups for Vitamin A Fortification

Low Income Countries

- **Preschool aged children**
(including newborns)
- **Women of reproductive age**
(during pregnancy & lactation)
- **School-aged/early adolescent children**
(although health effects uncertain)

Determine Suitability of Potential Food Fortification Vehicles

- Assess production potential and penetrance in markets of the poor
- Assess usual (year round) individual intake distributions by age/life stage group, SES strata, geographic location
- Evaluate (ecologically) joint distributions of nutritional need and vehicle intakes
- Evaluate potential efficacy of fortification candidate
- Estimate amounts of fortificant to add to vehicles to correct dietary inadequacies
- Evaluate likely safety of fortification levels
- Evaluate costs

Dietary Adequacy Assessment*: India

Dietary Intake Indicator	<5 yrs	6 -15 yrs	Women (child bearing age)
EAR	242	445	500
RDA	350	600	700
Avg VA intake (μg RAE)	158	147	184
Avg VA intake (as % EAR)	65%	33%	37%
Prevalence of Inadequacy (of the EAR)	72%	87%	85%
Dietary gap (vs RDA, μg RAE)	-193	-453	-516

* Based on population-based dietary surveys in 14 states

WHO Recommendations for Vitamin A

Nutrient	Flour Extraction Rate	Compound	Level of nutrient to be added in parts per million (ppm) by estimated per capita wheat flour availability (g/day)			
			<75 g/day	75-149 g/day	150-300 g/day	>300 g/day
Vitamin A	Low or High	Vitamin A Palmitate	5.9	3	1.5	1

VA Dietary References Intakes (ug retinol activity equivalents (RAE) per day)

Infant (AI / UL)

≤ 6 mo 400 / 600

7-12 mo 500 / 600

Children (RDA / UL)

1-3 yr 300 / 600

4-8 yr 400 / 900

9-13 yr 600 / 1700

Adults (RDA / UL)

Males, 14-70+ yr 900 / 3000*

Females 700 / 3000*

Pregnant (RDA / UL)

≤ 18 yr 750 / 2800

19 - 50 yr 770 / 3000

Lactating (RDA / UL)

≤ 18 yr 1200 / 2800

19 - 50 yr 1300 / 3000

*UL = 2800 RAE for 14-18 yr

AI = Adequate Intake; RDA = Recommended Dietary Allowance; UL = Tolerable Upper Intake Level. Institute of Medicine, National Academy of Sciences, 2001

Recommendations

- Fortification of foods with vitamin A is a potentially effective intervention to prevent or control vitamin A deficiency in low income countries where undernutrition and poverty coexist.

Recommendations

- Vitamin A fortification should be **motivated and guided by evidence of deficiency** as a public health problem. This evidence should be derived **from population-based findings** of deficient vitamin A status and dietary inadequacy of the vitamin or its food sources.
- Vitamin A deficiency is a public health concern in **preschool-aged** children, **women** of reproductive age and **school-aged** /young adolescents.
- Fortification of food with vitamin A should be designed to **correct estimated dietary inadequacy** in one or more vulnerable groups; that is, to fill a dietary gap.

Recommendations

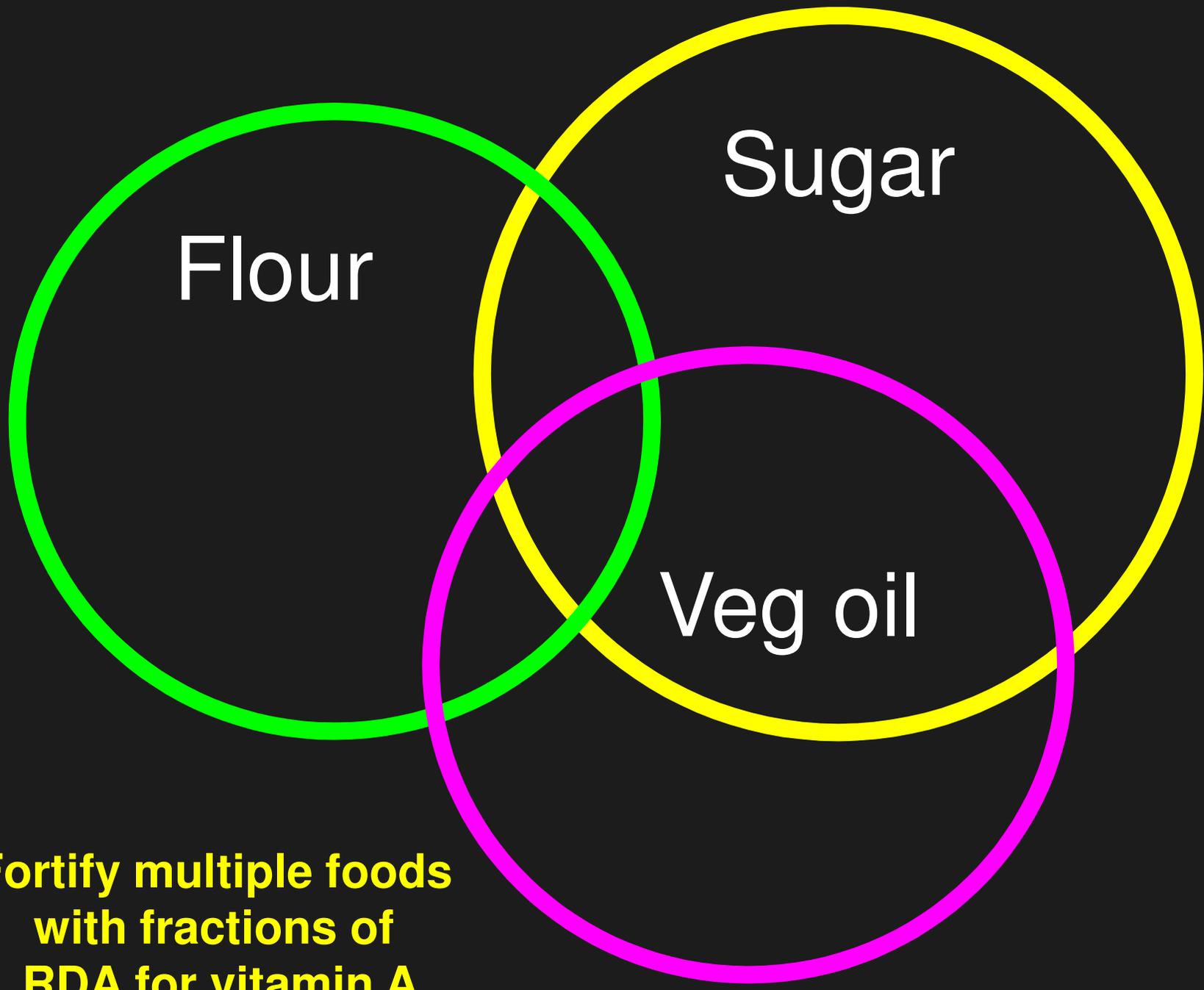
- In general, provision of **15% to 50% of an RDA** can be expected to meet both nutrition and safety goals.
- The form of vitamin A and premix to be used in fortification should be the **highest grade, appropriate** for the intended food vehicle, **stable** under ambient conditions and for the duration of expected use, and introduced into the food supply **in accordance with industry standards**.

Summary

- Wheat flour is a suitable candidate for vitamin A fortification.

Its selection as vehicle of choice should be guided by:

- (a) estimates of intake of vitamin A and wheat flour by intended beneficiaries;
- (b) levels of fortificant required to meet dietary corrective and safety goals;
- (c) stability under ambient conditions,
- (d) stability under usual conditions of product preparation (e.g., high temperature and humidity during cooking or baking) and product storage conditions, and
- (e) comparative costs.



Flour

Sugar

Veg oil

**Fortify multiple foods
with fractions of
RDA for vitamin A**



Thanks!