

# Standards for Rice Fortification

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# Standard

- For clarity and protection of manufacturers & consumers
- Quality of food:
  - Safety for consumption
  - Definition of quality – for standardization, possibility to monitor, ensuring acceptability
- If fortified, micronutrient content
- N.B. Standard vs Contract specification / Requirement Document

# Codex Alimentarius Commission

- Established by FAO and WHO in 1963
- Develops harmonised international food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair trade practices
- The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations
- While being recommendations for voluntary application by members, Codex standards serve in many cases as a basis for national legislation

# CODEX STANDARD FOR RICE

## CODEX STAN 198-1995

### 1. SCOPE

This standard applies to husked rice, milled rice, and parboiled rice, all for direct human consumption; i.e., ready for its intended use as human food, presented in packaged form or sold loose from the package directly to the consumer. It does not apply to other products derived from rice or to glutinous rice.

### 2. DESCRIPTION

#### 2.1 Definitions

2.1.1 **Rice** is whole and broken kernels obtained from the species *Oryza sativa* L.

2.1.1.1 **Paddy rice** is rice which has retained its husk after threshing.

2.1.1.2 **Husked rice** (brown rice or cargo rice) is paddy rice from which the husk only has been removed. The process of husking and handling may result in some loss of bran.

2.1.1.3 **Milled rice** (white rice) is husked rice from which all or part of the bran and germ have been removed by milling.

2.1.1.4 **Parboiled rice** may be husked or milled rice processed from paddy or husked rice that has been soaked in water and subjected to a heat treatment so that the starch is fully gelatinized, followed by a drying process.

2.1.1.5 **Glutinous rice; waxy rice:** Kernels of special varieties of rice which have a white and opaque appearance. The starch of glutinous rice consists almost entirely of amylopectin. It has a tendency to stick together after cooking.

### 3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

#### 3.1 Quality factors – general

3.1.1 Rice shall be safe and suitable for human consumption.

3.1.2 Rice shall be free from abnormal flavours, odours, living insects and mites.

#### 3.2 Quality factors – specific

3.2.1 **Moisture content** 15% m/m max

Lower moisture limits should be required for certain destinations in relation to the climate, duration of transport and storage. Governments accepting the Standard are requested to indicate and justify the requirements in force in their country.

3.2.2 **Extraneous matter:** is defined as organic and inorganic components other than kernels of rice.

3.2.2.1 **Filth:** impurities of animal origin (including dead insects) 0.1% m/m max

3.2.2.2 **Other organic extraneous matter** such as foreign seeds, husk, bran, fragments of straw, etc. shall not exceed the following limits:

	Maximum level
Husked Rice	1.5% m/m
Milled Rice	0.5% m/m
Husked Parboiled Rice	1.5% m/m
Milled Parboiled Rice	0.5% m/m

3.2.2.3 **Inorganic extraneous matter** such as stones, sand, dust, etc. shall not exceed the following limits:

	Maximum level
Husked Rice	0.1% m/m
Milled Rice	0.1% m/m
Husked Parboiled Rice	0.1% m/m
Milled Parboiled Rice	0.1% m/m

### 4. CONTAMINANTS

#### 4.1 Heavy metals

The products covered by the provisions of this standard shall be free from heavy metals in amounts which may represent a hazard to human health.

#### 4.2 Pesticide residues

Rice shall comply with those maximum residue limits established by the Codex Alimentarius Commission for this commodity.

### 5. HYGIENE

5.1 It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the *Recommended International Code of Practice – General Principles of Food Hygiene* (CAC/RCP 1-1969), and other Codes of Practice recommended by the Codex Alimentarius Commission which are relevant to this product.

5.2 To the extent possible in good manufacturing practice, the product shall be free from objectionable matter.

5.3 When tested by appropriate methods of sampling and examination, the product:

- shall be free from micro-organisms in amounts which may represent a hazard to health;
- shall be free from parasites which may represent a hazard to health; and
- shall not contain any substance originating from micro-organisms, including fungi, in amounts which may represent a hazard to health.

### 6. PACKAGING

6.1 Rice shall be packaged in containers which will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the food.

6.2 The containers, including packaging material, shall be made of substances which are safe and suitable for their intended use. They should not impart any toxic substance or undesirable odour or flavour to the product.

6.3 When the product is packaged in sacks, these must be clean, sturdy, and strongly sewn or sealed.

### 7. LABELLING

In addition to requirements of the Codex *General Standard for the Labelling of Prepackaged Foods* (CODEX STAN 1-1985), the following specific provisions apply:

#### 7.1 Name of the product

The name of the product to be shown on the label shall be in accordance with the definitions given in Section 2.1. The alternative names given in parenthesis shall be used in accordance with local practice.

#### 7.2 Labelling of non-retail containers

Information on non-retail containers shall be given either on the container or in accompanying documents, except that the name of the product, lot identification and the name and address of the manufacturer or packer shall appear on the container. However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

### 8. METHODS OF ANALYSIS AND SAMPLING

See relevant Codex texts on methods of analysis and sampling.

**GENERAL PRINCIPLES FOR THE ADDITION OF ESSENTIAL NUTRIENTS TO FOODS**  
**CAC/GL 09-1987 (amended 1989, 1991)**

**6. NUTRIENT ADDITION FOR PURPOSES OF FORTIFICATION**

**6.1** Fortification should be the responsibility of national authorities since the kinds and amounts of essential nutrients to be added and foods to be fortified will depend upon the particular nutritional problems to be corrected, the characteristics of the target populations, and the food consumption patterns of the area.

**6.2** The following conditions should be fulfilled for any fortification programme:

6.2.1 There should be a demonstrated need for increasing the intake of an essential nutrient in one or more population groups. This may be in the form of actual clinical or subclinical evidence of deficiency, estimates indicating low levels of intake of nutrients or possible deficiencies likely to develop because of changes taking place in food habits.

6.2.2 The food selected as a vehicle for the essential nutrient(s) should be consumed by the population at risk.

6.2.3 The intake of the food selected as a vehicle should be stable and uniform and the lower and upper levels of intake should be known.

6.2.4 The amount of the essential nutrient added to the food should be sufficient to correct or prevent the deficiency when the food is consumed in normal amounts by the population at risk.

6.2.5 The amount of the essential nutrient added should not result in excessive intakes by individuals with a high intake of a fortified food.

# What do specify in a standard

- Physical and sensory specifications
- Chemical specifications (e.g. protein content, heavy metal limits etc)
- Labeling and packaging specifications
- Manufacturing requirements
- Shelf life
- For fortification of rice:
  - Level + form of MN
  - Technology/ies used to fortify fortified kernels
  - Blending ratio of fortified kernels : rice grains

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United States Department of Agriculture

Farm Service Agency  
Kansas City Commodity Office  
P.O. Box 419205, MS 8698  
Kansas City, MO 64141-6205

### USDA COMMODITY REQUIREMENTS

MR24  
MILLED RICE  
AND FORTIFIED MILLED RICE

FOR USE IN  
INTERNATIONAL FOOD ASSISTANCE PROGRAMS

FedBizOpps Posting Date: 7/08/2014

Effective Date: 7/08/2014

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**B.** When the solicitation calls for Fortified Milled Rice, the following requirements apply:

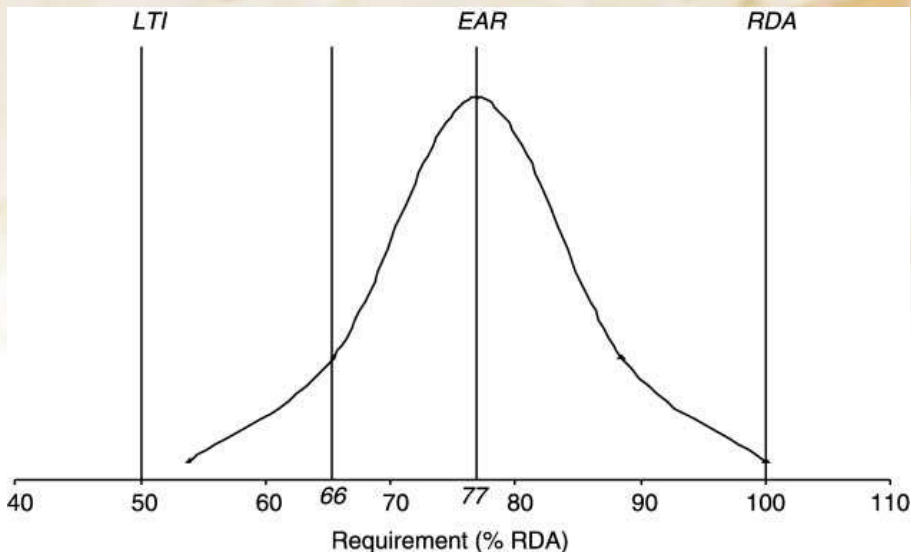
(1) Offers will be accepted for fortified rice fortified with rice-premix using technologies which will result in a final product that has been demonstrated to be effective, from the standpoints of end food preparation and utilization. Thus, rice-premix shall have scientific evidence from which scientific conclusions can be drawn, or is sufficient to demonstrate, that rice-premix and its use will deliver the requisite levels of micronutrients in one or more appropriate conditions of the intended use. It shall be, therefore, part of the pre-award survey to provide supportive documentation on such evidence.

(3) Any rice-premix, other than dusted rice, and meeting the requirements of B.(1) above, are acceptable, as long as the following requirements are met:

- a. Evidence shall be provided that rice-premix will closely approximate the size, shape, color, and density of the rice they are intended to fortify in both dry and cooked state. Physicochemical characterization using reproducible and quantitative measurements should be provided, when applicable.
- b. Micronutrient premix shall be loaded to a rice based carrier by any means that proves cost-effective and conforms to the quality standards in this CRD.

(5) Other food grade additives may be included in the micronutrient premix formulation as long as they do not impart a different flavor or appearance that would detract from the end product acceptability. Rice-premix should not, however, present any significant organoleptic (texture, taste, color, appearance) differentiation in a way that it would result unappealing to the average consumer. For instance, color differentiation of the rice-premix against the rice grains intended to be fortified could cause rejection of fortified rice in countries where it is a culture to pick uncharacteristic (color, shape and size) grains before further pre-washing for final cooking. Thus it is a very relevant requirement to obtain color, size and shape homogeneity.

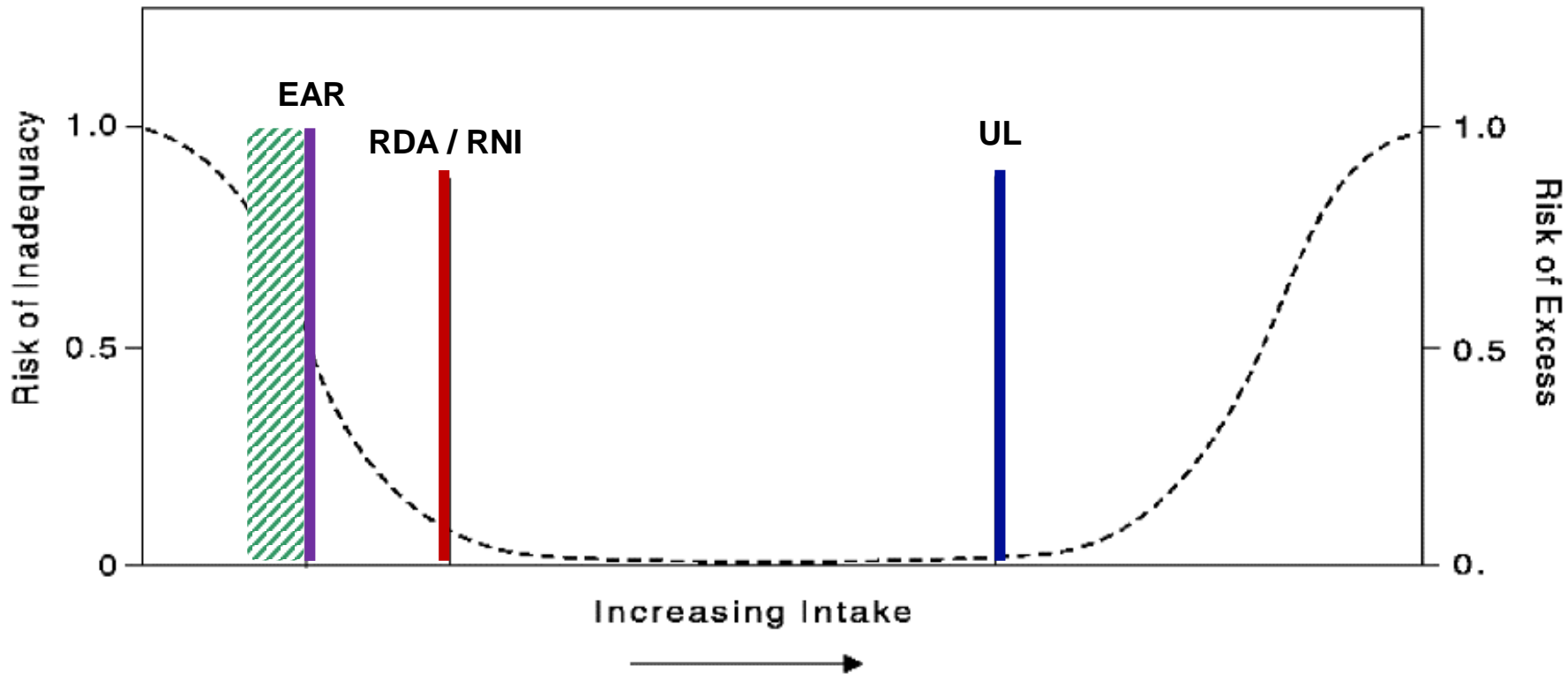


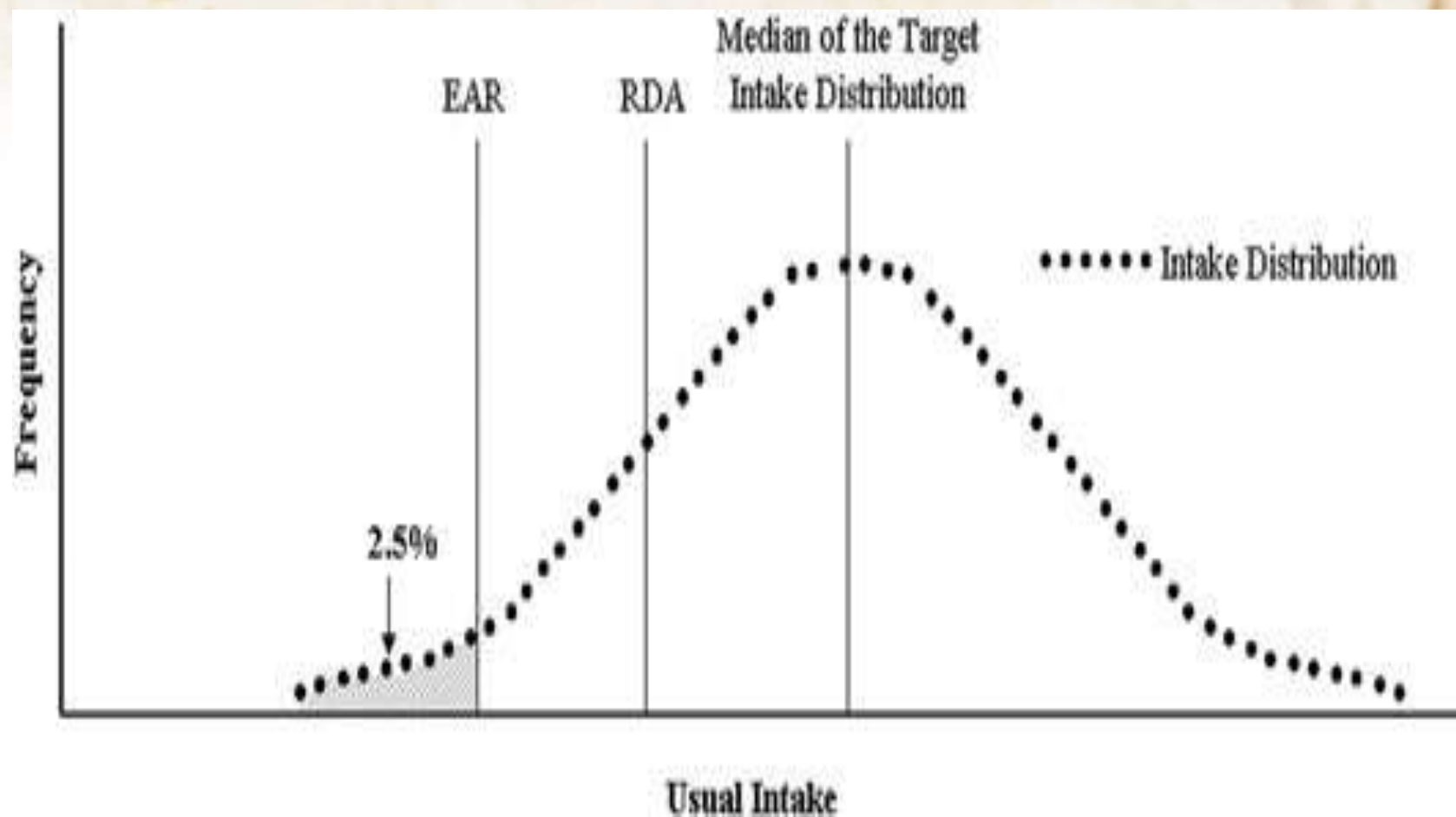


**EAR:** Estimated Average Requirement –  
 <2.5% should be below this level

**RNI:** Recommended Nutrient Intake – For 97.5% of the population,  
 this level will meet their individual requirement

**UL:** upper limit – 97.5% of the population will not observe adverse effects  
 when this level is consumed over a prolonged period of time  
 For correcting deficiencies, e.g. MAM treatment, amounts higher than UL  
 may be provided





# Rationale for proposed MN levels

- Public health significance of specific MN deficiencies
- Recommendations for flour fortification
- Composition of rice vs wheat and maize flours
- Technical feasibility of adding MN forms to rice
- No/limited impact on appearance, taste, shelf life
- Evidence of impact on nutritional status where available (evidence is accumulating)
- Cost considerations (most cost in producing fortified kernels, not in the mixture of MNs that is added)

# MN content of wheat and maize flours compared to rice (per 100 g)

Nutrient	Rice - white	Rice - brown	Wheat flour - whole	Corn flour - white	Corn flour - whole	Added to flour if >300 g/d
Iron (mg)	0.8	1.8	3.6	2.38	2.38	4
Zinc (mg)	1.16	2.02	2.6	1.73	1.73	5
Folic acid (ug DFE)	9	20	44	25	25	100
Vit B12 (ug)	0	0	0	0	0	0.8
Vit A (IU)	0	0	9	3	214	333
Thiamin (mg)	0.07	0.413	0.502	0.246	0.246	
Niacin (mg)	1.6	4.3	6.0	1.9	1.9	
Vit B6 (mg)	0.145	0.51	0.41	0.37	0.37	
Riboflavin (mg)	0.048	0.043	0.165	0.08	0.08	

# Which MN to add to rice?

As for maize and wheat flours:

Fe  
Folic Acid  
Vitamin B12  
Vitamin A  
Zn

For rice, also add MN lost through polishing:

Thiamin  
Vitamin B6  
Niacin

(consider also for maize flour)

De Pee S. Annals NY  
Acad Sci 2014

Commonly added in  
large scale programs

Also possible:

- Vitamin E
- Vitamin D
- Selenium
- Lysine

Possible, but:

- Riboflavin
- Beta-carotene
- Calcium
- Vitamin C
- DHA



## Proposing nutrients and nutrient levels for rice fortification

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**Table 3.** Nutrient levels proposed for fortified rice at moment of consumption (mg/100 g)<sup>g</sup>

Nutrient	Compound <sup>a</sup>	<75 g/d	75–149 g/d	150–300 g/d	>300 g/d	EAR <sup>b</sup>
Iron <sup>c</sup>	Micronized ferric pyrophosphate	12	12	7	7	
Folic acid <sup>d</sup>	Folic acid	0.50	0.26	0.13	0.10	0.192
Vitamin B12 <sup>d</sup>	Cyanocobalamin	0.004	0.002	0.001	0.0008	0.002
Vitamin A <sup>d</sup>	Vitamin A palmitate	0.59	0.3	0.15	0.1	0.357 (f) 0.429 (m)
Zinc <sup>e</sup>	Zinc oxide	9.5	8	6	5	8.2 (f) 11.7 (m)
Thiamin <sup>f</sup>	Thiamin mononitrate	2.0	1.0	0.5	0.35	0.9 (f) 1.0 (m)
Niacin <sup>f</sup>	Niacin amide	26	13	7	4	11 (f) 12 (m)
Vitamin B6 <sup>f</sup>	Pyridoxine hydrochloride	2.4	1.2	0.6	0.4	1.1

# Fortification levels (mg/100 g)

Nutrient	De Pee (150-300 g rice/d)	Bangladesh	USDA	EAR
Vitamin A (vit A palmitate)	0.15	0.15	0.11	0.36-0.43
Vitamin B1 (thiamin mononitrate)	0.5	0.4	0.47	0.9-1.0
Vitamin B3 (niacinamide)	7	--	5.6	11-12
Vitamin B6 (pyridoxine hydrochloride)	0.6	--	0.6	1.1
Vitamin B12 (cyanocobalamin)	0.001	0.001	0.0011	0.002
Folic acid (folic acid)	0.13	0.13	0.15	0.19
Iron (micronized ferric pyrophosphate)	7	6	4.8	-
Zinc (zinc oxide)	6	4	3.5	8-12

# How to set fortification level amidst several MN interventions?

- Different fortified foods – same MNs?
- Foods for general population or specific groups?
- Supplements (MNP, Fe/FA tablets etc) – coverage & frequency?
- IMAPP: Intake Monitoring, Assessment and Planning Program
- Need to assess, among different target groups:
  - MN intake (24-hr recall for 1-2 days)
  - Intake of specific foods

# With regard to MN fortification levels, standard should specify:

- Target level at  $t=0$ , including overages  
---- or ----
- Target level at moment of consumption = level guaranteed at e.g. 12 months of shelf life at 30 C
- Allowed overage, to compensate for losses (20-30%)
- Variation allowed in levels ex-factory (variability of: fortification level, blending ratio, analytics)
- Note, vitamin A is most sensitive -> greatest losses

# Drafting standards

- Aim: Protect health of consumers & fair trade practices
- Quality: Safe & Acceptable & Nutritious
- Clarity re interpretation
- Feasible to achieve
- Possible to monitor & enforce

= Consultative process!

Led by Government Food Regulatory Authority,  
informed by Codex Alimentarius & data, and  
supported by expert groups

# Conclusions

- Standards for fortified rice specify quality for safety, acceptability and nutrient content – for benefit of consumers and manufacturers
- Drafting standards is a consultative process
- Codex Alimentarius: Standard for rice & for fortification
- Set MN levels
  - based on actual vs recommended nutrient intake and rice consumption levels OR
  - target EAR when intake is likely low and UL high (de Pee, 2014)
- Standards need to be monitored and enforced



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Thank you

Terima kasih

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Salamat Po

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