

# Micronutrient Deficiencies, Their Impact on Health and Development, and Cost Effective Interventions to Address them

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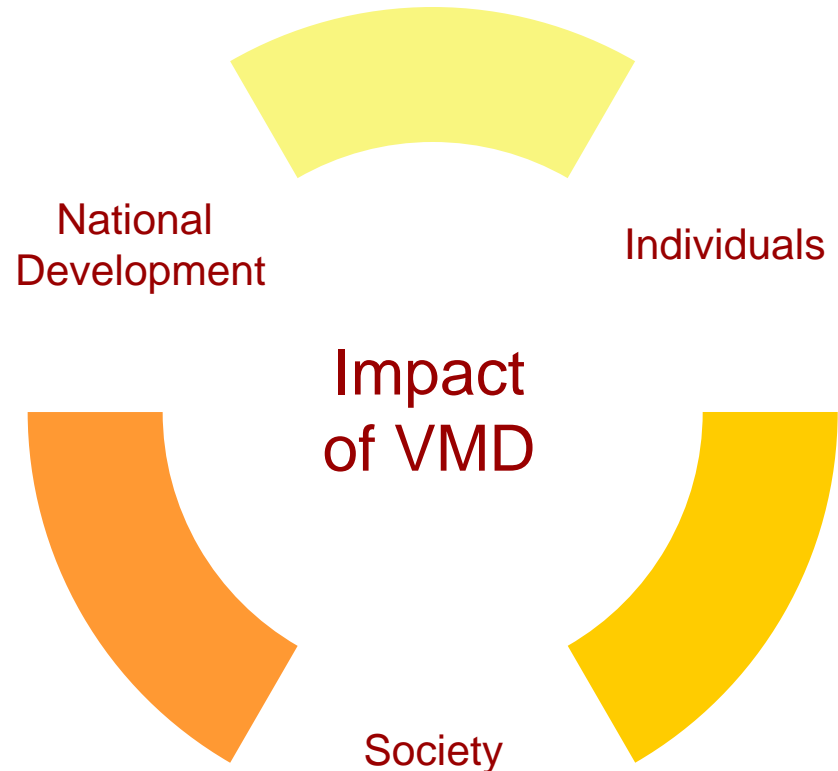
# What Are Micronutrients?



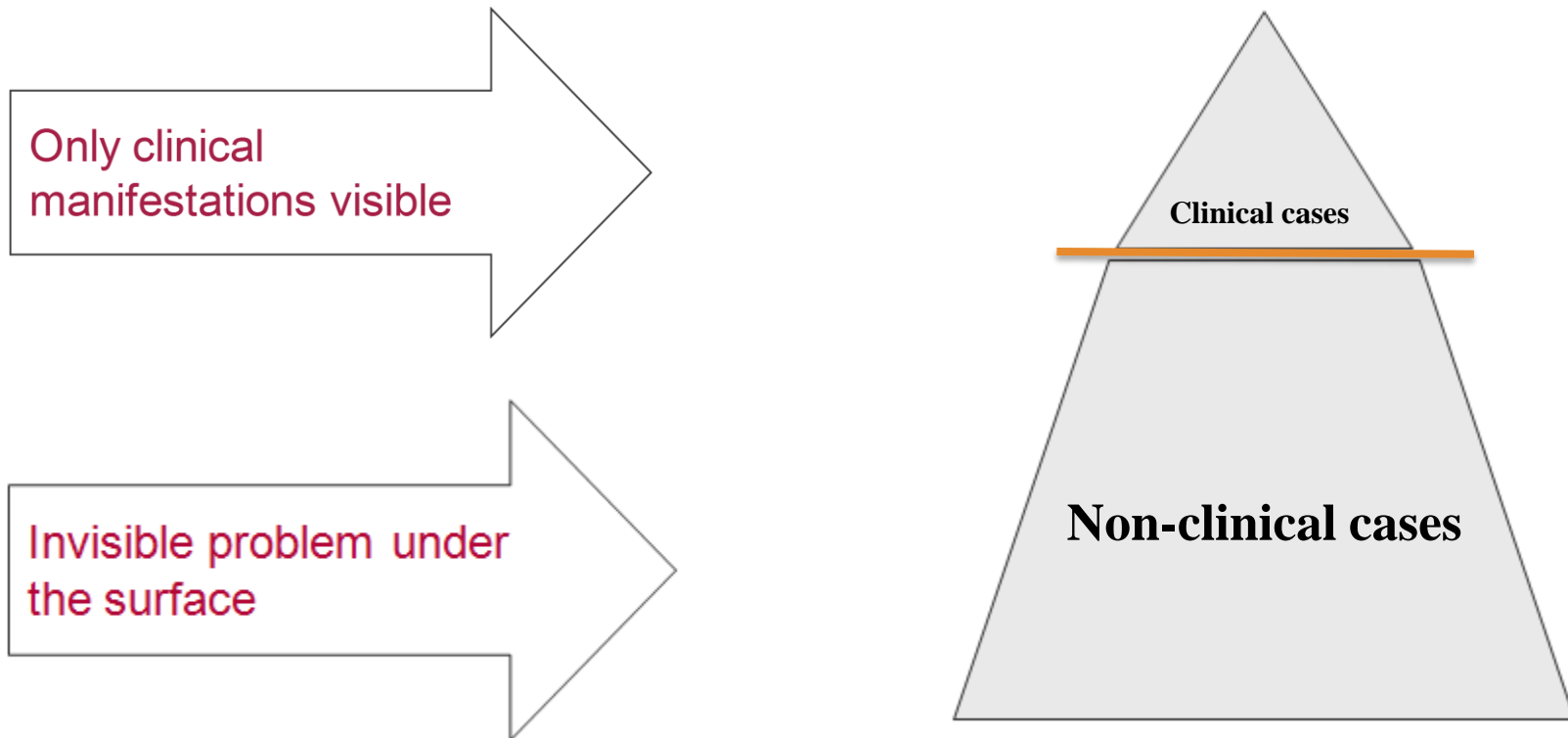
- ❖ Micronutrients are vitamins and minerals that humans need to consume in small amounts for adequate health and development.
- ❖ These substances are the “magic wands” that enable the body to produce enzymes, hormones and other substances essential for proper growth and development.
- ❖ As tiny as the amounts are, however, the consequences of their absence are severe.

# The Global Burden of Micronutrient Deficiencies

- Worldwide, >2 billion people affected
  - Iron: >2 Billion
  - Iodine: 2 Billion
  - Vitamin A: 254 million children
- VMD = 7.3% of the Global Burden of Disease
- 1.6 million deaths attributed to iron and vitamin A deficiencies alone
- Over 45 million Disability Adjusted Life Years (DALY's) lost



# Micronutrients – Important Health Problem



VMDs remain an underestimated problem !

# Benefits from reducing vitamin and mineral deficiencies

- ✦ Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development of populations the world over, particularly **children** and **pregnant women**



Harold Alderman, 2005. 'Linkages between poverty reduction strategies and child nutrition: an Asian perspective', *Economic and Political Weekly* 40:4837–42



- ✦ The study argues that countries may lose 2 to 3% of their Gross Domestic Product (GDP) as a result of iron, iodine, and zinc deficiencies

# Iodine



# The Challenge





Iodine deficiency disorders (IDD), which can start before birth, jeopardize **children's mental health** and often their very survival.



Serious iodine deficiency **during pregnancy** can result in stillbirth, spontaneous abortion, and congenital abnormalities such as cretinism, a grave, irreversible form of mental retardation that affects people living in iodine-deficient areas.

However, of far greater significance is IDD's less visible, yet pervasive, mental impairment that reduces intellectual capacity at home, in school and at work.

# The Response: Iodized Salt

-  A spectacularly simple, universally effective, wildly attractive and incredibly cheap technical weapon – that's iodized salt!
-  Five US cents a year and a teaspoon of iodine for a lifetime – a small price to pay for protection against the devastating effects of iodine deficiency
-  Partnerships have been crucial to turning the tide against IDD. Alliances between WHO, UNICEF, ICCIDD (International Council for Control of Iodine Deficiency Disorders), international and bilateral agencies and the salt industry have helped countries set up permanent national salt iodization programs.
-  This strategy has been implemented in most countries where iodine deficiency is a public health problem. Globally, UNICEF estimates that 66% of households now have access to iodized salt.

# Iodine



Today we are on the verge of eliminating it – an achievement that will be hailed as a major public health triumph that ranks with getting rid of smallpox and poliomyelitis

# Iron



## **Iron deficiency: a public health problem**

An estimated 2 billion people suffer from anaemia primarily due to iron deficiency.

# Consequences of Iron Deficiency

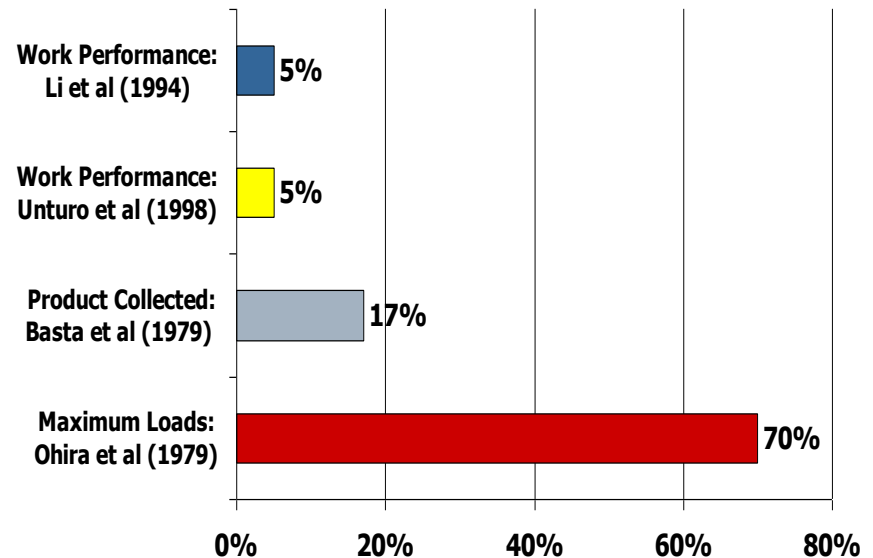


- ❗ Iron deficiency anaemia (IDA) causes developmental and cognitive impairment in children, negatively impacting school performance.
- ❗ Severe anaemia is also a risk factor for maternal, child, and perinatal mortality and is associated with low birth weight.
- ❗ IDA is a major cost to national economies.

# Losses in Anemic Adult Workers due to Iron Deficiency Anemia

- ❑ Health Impact
  - ❑ Lower aerobic capacity
    - ❑ 10-75%
  - ❑ Weakness & fatigue
- ❑ Work Impact:
  - ❑ Lower individual performance or output.
- ❑ Coefficient for Analysis
  - ❑ 5% Deficit in Manual Labor
  - ❑ 17% Deficit Heavy Manual Labor
- ❑ Parenting & Voluntary activities not calculated

Some Controlled Studies:  
Improved Work Performance  
From Correction of Anemia



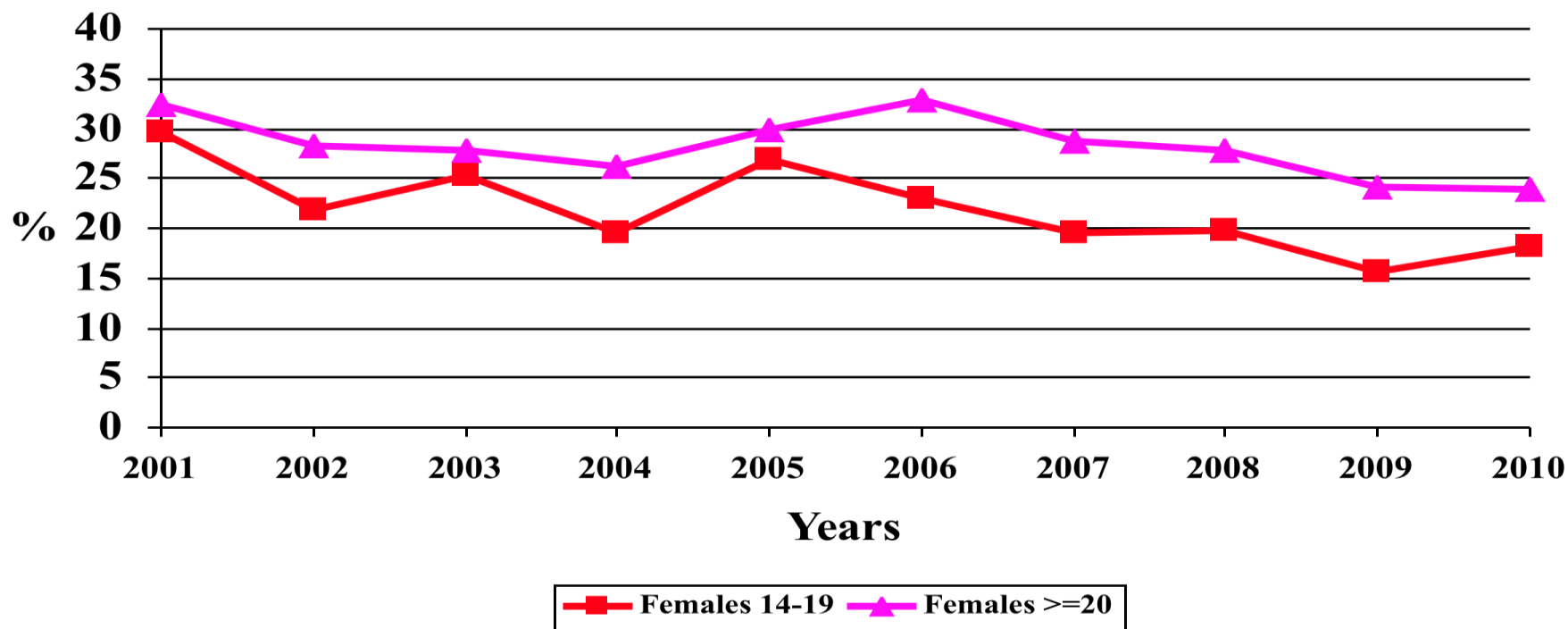
# Child Cognition Deficit Associated with Adult Earnings Deficit

Country	Cognitive Deficit	Earnings Deficit	Sources
Chile	0.5 SD	3-5%	Selowsky & Taylor (1973)
U.S.		5%	Altonji & Dunn (1996)
Pakistan		10-12%	Alderman et al. (1996)
Ghana	1 SD	22-33%	Glewwe (1996)
Kenya		17-23%	Boissiere et al. (1985)
Tanzania		8-13%	Boissiere et al. (1985)
Columbia		7-9%	Psacharopoulos et al (1992)
South Africa		35%	Moll PG (1998)

- ❑ Consensus workshop on evidence linking cognitive test scores and earnings concludes:
  - ❑ “0.25 SD increase in IQ, which is a conservative estimate of the benefit... would lead to a 5%-10% increase in wages.”

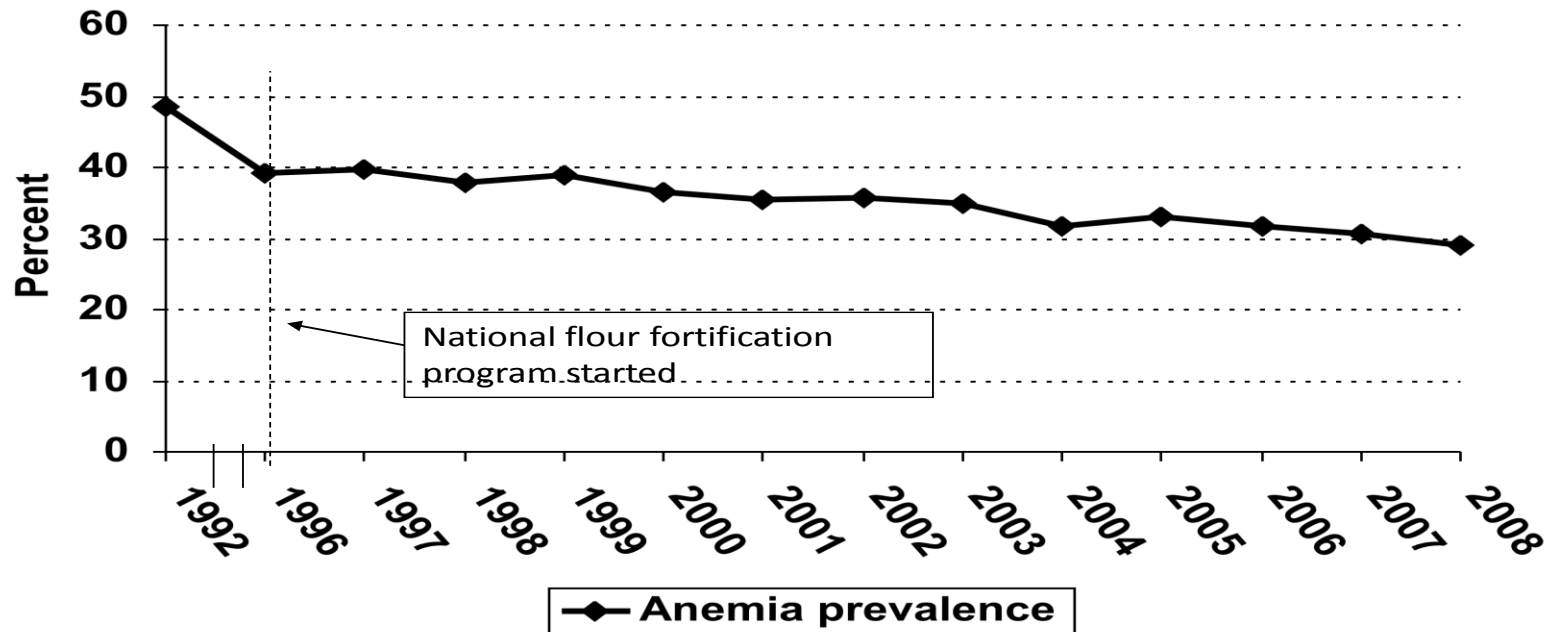
# Examples of Impact of Flour Fortification

## Anemia Trends Among Kuwaiti Females Kuwait (Sentinel) Nutrition Surveillance System



# Examples of Impact of Flour Fortification

Trends in prevalence of anemia in 1<sup>st</sup> trimester pregnant women and proportion of pregnant women seeking prenatal care in the 1<sup>st</sup> trimester – Oman



Source: Personal communication; Ms. Deena Alasfoor, Oman Director of Nutrition

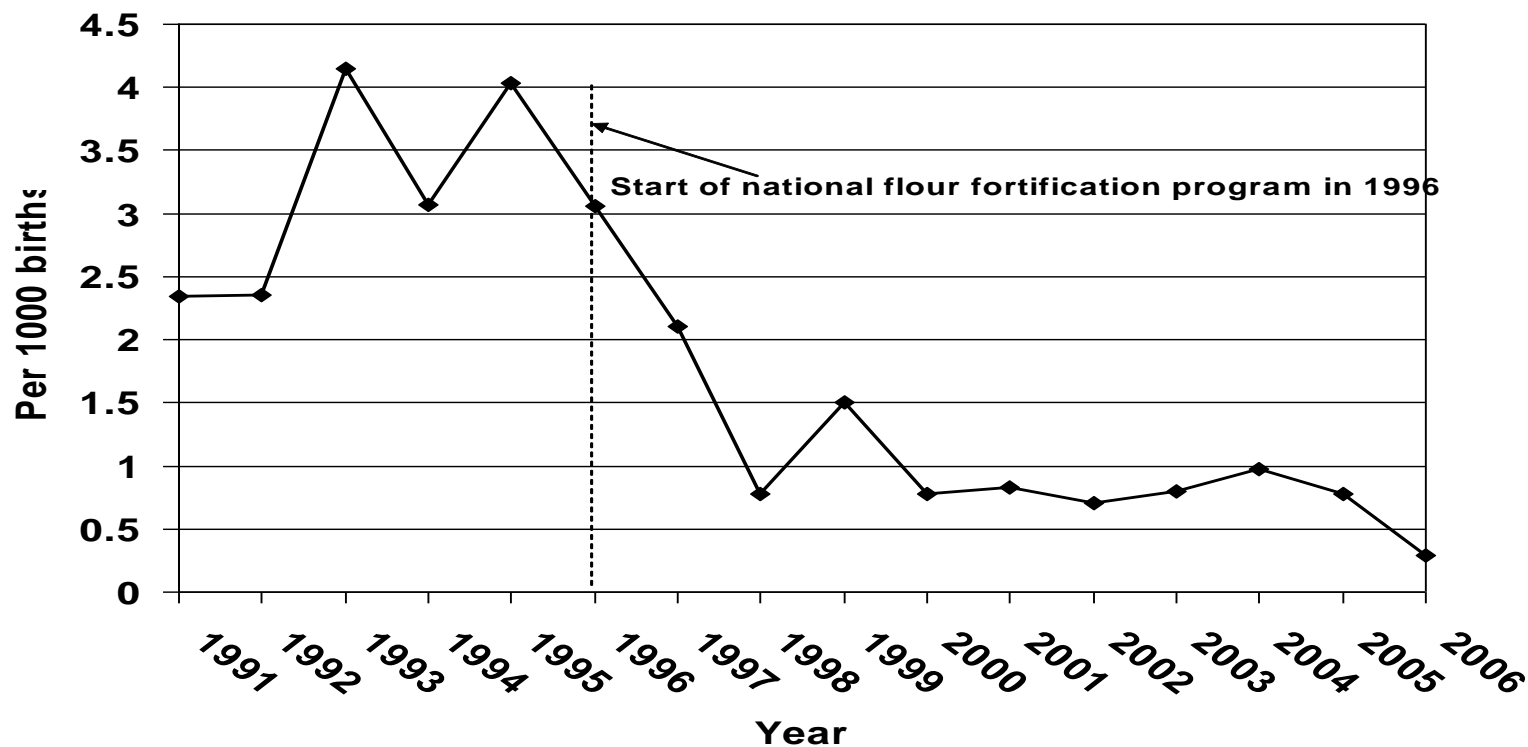
# Folic Acid Deficiency & Neural Tube Defects

- Pathway #1: Mortality
- Pathway # 3: Disability
- Pathway #4: Cost of Care
  - Surgeries, Care & Rehab, Welfare Payments
- Impacts Not Measured
  - Cleft Pallate
  - Neuroblastoma
  - Congenital Heart Defects
  - Adult Heart attack and Stroke



# Trends in Incidence of Spina Bifida

## Oman Ministry of Health Reporting System



# Bread: A Staple Food





# History of Bread

- 🍞 19<sup>th</sup> Century: Mechanized roller milling replaced big stone wheels
- 🍞 Faster finer milling resulted in softer, whiter and more refined flour
- 🍞 Flour with a longer shelf life but minus the wheat germ which has the B-Vitamins, antioxidants and the omega-3 fatty acids.

# Whole & Refined Grains

## What's the Difference?

**Two main types of grain products: whole and refined**

-  **Whole grains** contain the entire grain kernel—the bran, germ, and endosperm. Examples include whole-wheat flour, bulgur, oatmeal, whole cornmeal, and brown rice.
-  **Refined grains** have been milled—the bran and germ are removed. This process also removes much of the B- vitamins, iron, and dietary fiber.

*Examples of refined grains are wheat flour, enriched bread, and white rice. Most refined grains are enriched. This means certain B- vitamins (thiamin, riboflavin, niacin, folic acid) and iron are added back after processing. Fiber is not added back to enriched rains.*

# Health Consequences of Refined Flour

- Epidemics and Beri Beri
- Vitamin B1 (Thiamine) Deficiency



# Health Consequences of Refined Flour

- Epidemics of Pellagra
- Vitamin B3 (Niacin) Deficiency

## Symptoms

- Skin inflammation
  - Diarrhea
  - Weight loss
  - Irritability
  - Depression
  - Confusion
  - Memory loss



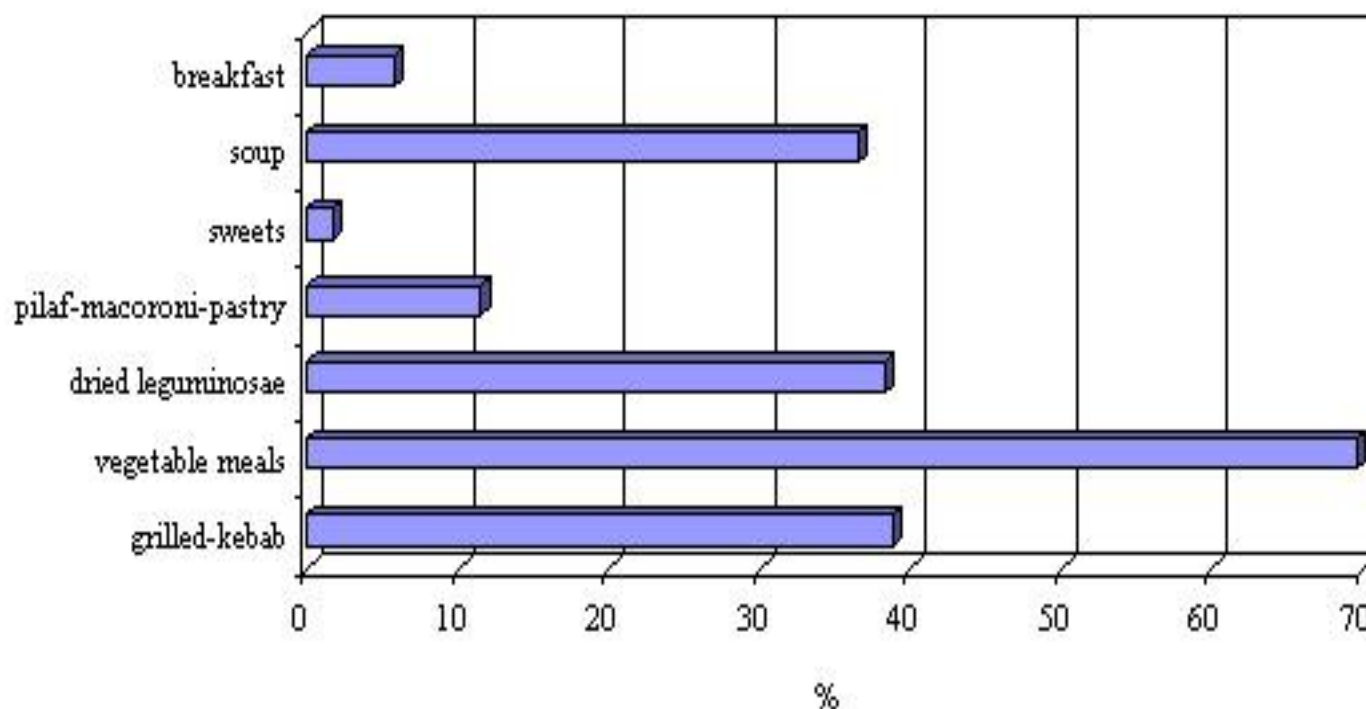
# Health benefits of vitamins added to flour and bread

- 🍞 Reduces child mortality
- 🍞 Enhances child growth and development
- 🍞 Enhances physical and intellectual performance  
Of children
- 🍞 Reduces maternal mortality
- 🍞 Eliminates nutritional blindness, goiter and  
Cretinism
- 🍞 Reduces the risk for chronic disease in later life.










# Bread Consumption in Turkey

## Meals which are mostly consumed with bread



# In Summary

-  Bread is a major part of our diet
-  It is important that we eat healthy bread that is produced, sold and stored under hygienic conditions
-  Whole grain bread is healthier but.... When one eats bread made with refined flour then: Fortified Bread is a simple solution.
-  The burden of vitamin and mineral deficiencies in the world is very high, but can be eliminated
-  Flour fortification is a simple, low cost, and well established method for reducing the health, economic and societal burden of nutrient deficiencies
-  Fortification improves the nutritional quality of flour
-  Flour producers and health sector can become partners in improving health and well-being of people throughout the world



# Tesekkuler