

# Nutritional Anemia

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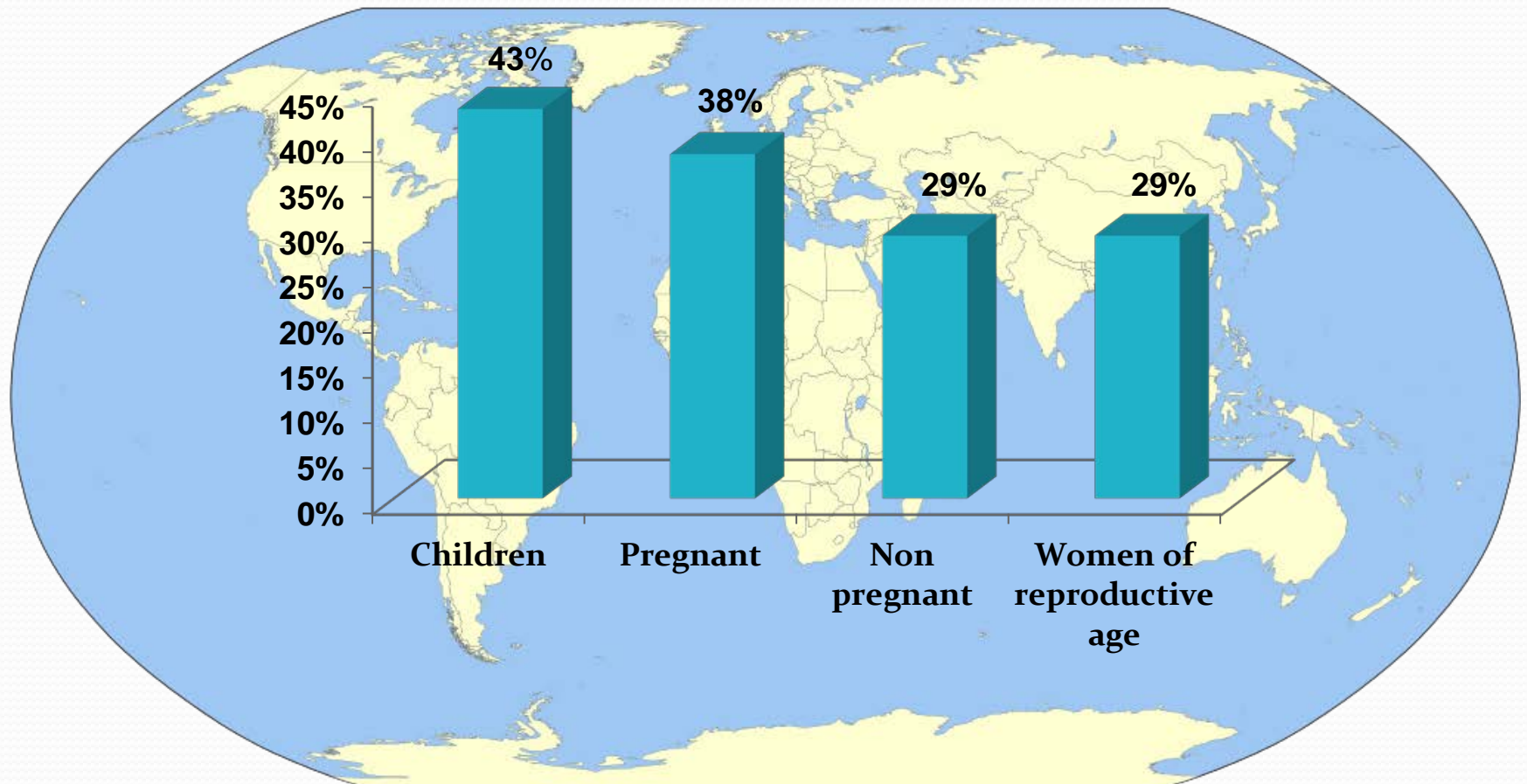
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# Definition

“Anemia is the deficiency in the size or number of red blood cells or the amount of hemoglobin they contain”

# Global Prevalence Of Anemia



# Prevalence Of Anemia In Pakistan



- Children 58.8%
- Women of reproductive age 52%
- Non pregnant women 52.2%
- Pregnant women 51%

World Health Organization, Global Health Observatory Data Repository/World Health Statistics 2016

# Iron Deficiency Anemia among Women of Reproductive Age, an Important Public Health Problem: Situation Analysis

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**Received date:** July 13, 2016; **Accepted date:** August 3, 2016; **Published date:** August 09, 2016

## Abstract

**Background:** Iron deficiency is a major cause of anemia and is more prevalent in developing countries, posing additional burden on health care systems, in the presence of scarcity of resources. The high-risk group consists of females and children but comparatively it is higher in females due to physiological reasons. Multiple factors can predict anemia, which in turn leads to various adverse outcomes.

**Results:** Multiple determinants of iron deficiency anemia have been identified in the literature including genetic and environmental factors. Some of these factors are lack of proper diet, poor socioeconomic status, high parity of women, access to poor health and genetic etc. Moreover, anemia can result in various poor outcomes like fatigue, poor mental health, lack of concentration, poor fetal-neonatal outcomes like stillbirth, preterm birth and postpartum Hemorrhage.

**Conclusion:** Iron deficiency anemia is one of the important public health problems in developing countries among the women of reproductive age group. Multiple factors like age, parity, socioeconomic status and diet can determine the stores of iron in the women of reproductive age group. Anemia can lead to multiple adverse outcomes, which can be prevented by doing appropriate cost-effective interventions on time.



# Cut Offs

## Hemoglobin Levels

Severe deficiency	<7 gm/dl
Moderate deficiency	7 - 11.99 gm/dl
Normal (women)	$\geq 12$ gm/dl
(Men)	$\geq 13$ gm/dl

World Health Organization (WHO)



# Laboratory Investigations

Hematocrit

- Percentage of blood volume as RBCs

Hemoglobin

- Concentration of hemoglobin in blood

Mean Corpuscular Volume (MCV)

- Average size of RBC

Mean Corpuscular Hemoglobin(MCH)

- Average hemoglobin content of RBC

# Types of Anemia

## Hypochromic, microcytic anemia (low MCHC, low MCV)

- Iron deficiency anemia
- Thalassemias
- Anemia of chronic diseases

## Normochromic, Macrocytic anemia (normal MCHC, high MCV)

- Vitamin B<sub>12</sub> Deficiency
- Folate Deficiency

## Normochromic, normocytic anemia (normal MCHC, normal MCV)

- Anemias of chronic diseases
- Hemolytic Anemia (characterized by accelerated destruction of RBC's)
- Anemia of acute hemorrhages
- Aplastic Anemia (characterized by disappearance of RBC's precursor from the marrow)





# Nutritional Anemia

“A condition in which the Hb content of the blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency”

World Health Organization (WHO)

# Iron Deficiency Anemia

- Most common and widespread nutritional deficiency in the world
- One of the top 10 contributors to the global burden of disease
- 50% of anemia globally is related to iron deficiency
- One of the three micronutrients causing hidden hunger in the world

# Tests for Iron Deficiency:

Tests	Indicator	Availability	Significance
Serum iron	Poor	Decreases in iron deficiency	highly variable day to day and during the day
Ferritin	<b>Most sensitive</b>	Decreases in iron deficiency	chief storage form of iron; directly proportional to iron stored in cells
Total iron binding capacity*	May be a good indicator	Increases in iron deficiency	capacity of transferrin to bind iron
Transferrin saturation	<b>Good indicator</b>	Decreases in iron deficiency	Indicates iron-binding sites of transferrin are being occupied by iron. **

\*\*Saturation of transferrin (calculated by dividing serum iron by the TIBC)

# Causes Of IDA

## Inadequate Intake

- Too little iron in the diet due to:
- Poverty
- Infants
- Vegetarian diet & diet deficient in iron, protein, folate & vitamin C

## Blood loss

- Heavy menstruation, ulcer, Hookworm infection, hemorrhoids, rectal/colon cancer or use of NSAIDS

## Inability to absorb iron:

- Gastric resection, Celiac, Crohn's disease

## Failure to meet requirements:

- Infancy and adolescence
- Pregnancy and lactation

## Drug interference

- Drugs like antacids, PPI can cause anemia

# Causes of Anemia in Women

## Poor maternal nutrition

- Before and during pregnancy

## Illiteracy

- Lack of knowledge

## Food insecurity

- Chronic food insecurity leads to various deficiency disorders

## Unable to meet demands

- When requirements are high in pregnancy and lactation

## Intra household food distribution

- Food supplies are limited and inadequate
- Low rank distribution of nutrient rich foods

## Cultural beliefs

- Strict Vegetarians
- Hot and cold foods

# Symptoms of Anemia

**Red = In severe anemia**

## **Eyes**

- Yellowing

## **Skin**

- Paleness
- Coldness
- Yellowing

## **Respiratory**

- Shortness of breath

## **Muscular**

- Weakness

## **Intestinal**

- Changed stool color

## **Central**

- Fatigue
- Dizziness
- **Fainting**

## **Blood vessels**

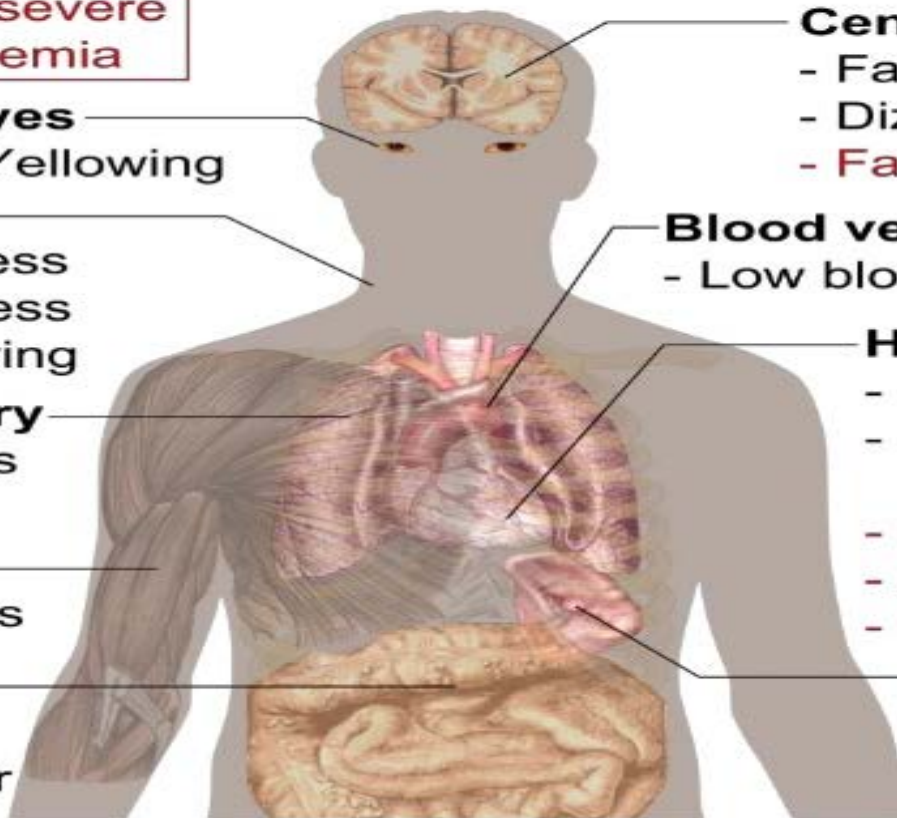
- Low blood pressure

## **Heart**

- Palpitations
- Rapid heart rate
- **Chest pain**
- **Angina**
- **Heart attack**

## **Spleen**

- Enlargement



# Nutrition Focused Physical Examination



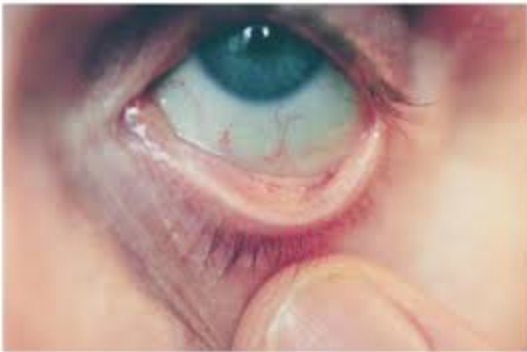
**Glossitis**



**Koilonychia  
(spoon-shaped nails)**



**Pale Hands**



**Pale conjunctiva**



**Angular Stomatitis**





# Detrimental Effects

Effects
Pica
Increased heart rate
Increased maternal and fetal death
Impaired immunity
Delayed psychomotor development
Reduced working capacity



# Recommendation

Groups	Requirements
Men & Post menopausal women	8 mg/day
Women childbearing age	18 mg/day
Pregnant	27 mg/day
Lactating	9-10 mg/d

Food and Nutrition Board, Institute of Medicine, Nutrition Academies

# Supplementation for Iron Deficiency Anemia

- Oral iron salts
  - Ferrous forms better absorbed than ferric (ferrous sulfate, ferrous lactate, ferrous fumarate)
- Best absorbed on an empty stomach but if irritation occurs, give with meals
- Generally supplement for 3 months (4-5 months if taken with meals)

# Earlier Initiation and Use of a Greater Number of Iron-Folic Acid Supplements during Pregnancy Prevents Early Neonatal Deaths in Nepal and Pakistan

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## Abstract

**Introduction:** Early neonatal deaths account for 75% of neonatal deaths globally. Antenatal iron-folic acid (IFA) supplementation has significantly reduced the risk of early neonatal deaths in China and Indonesia. We investigated the impact of antenatal IFA supplements on the risk of early neonatal deaths in Nepal and Pakistan during the last decade.

**Findings:** The adjusted risk of early neonatal deaths was significantly reduced by 51% (aHR=0.49, 95% CI=0.32–0.75) in Nepal and 23% (aHR=0.77, 95% CI=0.59–0.99) in Pakistan with any use of IFA compared to none. When IFA supplementation started at or before the 5<sup>th</sup> month of pregnancy, the adjusted risk of early neonatal mortality was significantly reduced by 53% in Nepal, and 28% in Pakistan, compared to no IFA. When >90 IFA supplements were used and started at or before 5<sup>th</sup> months, the adjusted risk of early neonatal deaths was significantly reduced by 57% in Nepal, and 45% in Pakistan. In Nepal 4,600 and in Pakistan 75,000 early neonatal deaths could be prevented annually if all pregnant women used >90 IFA supplements and started at or before the 5<sup>th</sup> month of pregnancy.

**Conclusions:** Any use of IFA supplements was significantly associated with reduced risk of early neonatal deaths in Nepal and Pakistan. The greatest mortality sparing effect of IFA on early neonatal deaths in both countries was with early initiation and use of a greater number of supplements.

**Citation:** Nisar YB, Dibley MJ (2014) Earlier Initiation and Use of a Greater Number of Iron-Folic Acid Supplements during Pregnancy Prevents Early Neonatal Deaths in Nepal and Pakistan. PLoS ONE 9(11): e112446. doi:10.1371/journal.pone.0112446

# Side Effects

Individual side-effects reported in the FeSO<sub>4</sub> group/arm for the studies where this information was available.

First author, year	n	Constipation	Nausea	Diarrhoea	Abdominal pain	Vomiting	Heartburn	Others	Dark stools
Baykan, 2006 [62]	82	9	1	1	7	1			4
Cook, 1990 [63]	67	16	15	6	6	0		24 (flatulence)	38
Davis, 2000 [64]	14	5	5						3
Fouad, 2013 [65]	20	1	0	3	3			1 (flatulence)	
Ganzoni, 1974 [66]	90	12	9	21	13		12		
Gordeuk, 1987 [67]	24	1	11	3	6		2		
Hallberg, 1966_1 [24]	175	14	10	10	4		4		
Hallberg, 1966_2 [24]	111	11	6	7	8		4		
Hallberg, 1966_3 [24]	170	19	5	11	6		3		
Levy, 1978 [68]	107	27	8	12	13	8	7	24 (flatulence)	
Maghsudlu, 2008 [69]	185	4	19		5	19			
Mirrezaie, 2008 [34]	49	1	17		2		5		
Meier, 2003 [70]	38	9	24	5		13			
Makrides, 2003 [71]	200	25	58		70	24	136		3
Pereira, [40]	10	3	3	2	7		5		8
Yalcin, 2009 [73]	24	3	1	2	2				4
Agarwal, 2006 [74]	45	4	2	2					3
Auerbach, 2004 [75]	43		1						
Breyman, 2008 [77]	117	8							

# Supplementation Cont'd:

If patient fails to respond there may be

- Non Compliance to supplements
- Malabsorption  
(celiac disease, steatorrhea, hemodialysis)
- Continuous bleeding
- Need for IV iron dextran



# Dietary Sources

## Heme



## Non Heme





# Enhancers

## Bioavailability of iron

- Lower the Fe stores, the greater the rate of absorption
- Heme sources (meat, poultry, fish)— about 15% absorbable
- Nonheme iron (grains, vegetables, eggs)—about 3% to 8% absorbable

## Vitamin C

- Binds iron to form a readily absorbed complex

## Germination or fermentation of cereals/legumes

- Reduces the phytate content and improves bioavailability of iron

## MFP Factor

- MFP factor if taken with non-heme iron from plant based foods improves iron absorption

# Inhibitors

## Whole grain cereals and vegetables

- Phytate, oxalate content hinders absorption
- Vegetable fiber may inhibit nonheme iron absorption

## Tea and Coffee consumption

- Decreases iron absorption by 50% due to tannins  
( **Naila baig Ansari et al. 2008**)

## Dietary supplements

- Ca, Al , Mg , Zn

## Regular use of antacids

- Effects absorption of iron

## Chelating Factors

- Iron in egg yolk poorly absorbed due to phosvitin



# NUTRITION MYTHS



YOU SHOULD  
KNOW



Google

pomegranate iron



ALL

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BOOKS

0.3 mg

Iron

Pomegranate

100 grams



More about Pomegranate

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apple iron value



ALL

NEWS

IMAGES

VIDEOS

BOOKS

0.1 mg

Iron

Apple



100 grams



Google

beetroot iron



ALL

VIDEOS

NEWS

IMAGES

BOOKS

0.8 mg

Iron

Beets



100 grams



More about Beetroot

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beef iron value



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BOOKS

2.6 mg

Iron

Beef, ground, 85% lean meat /



100 grams



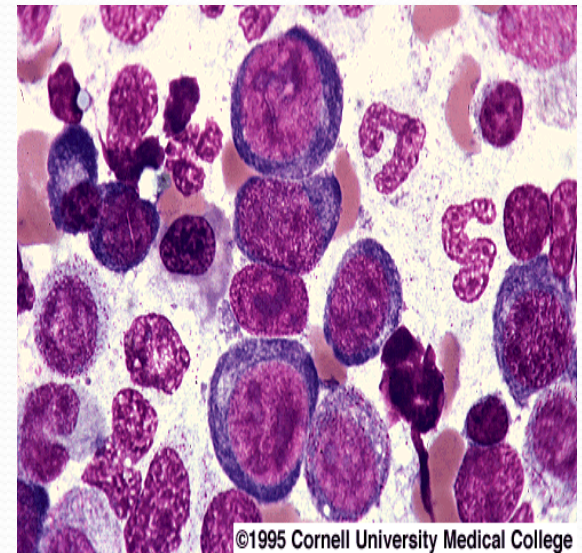
More about Beef

# Megaloblastic Anemias

“Anemia characterized by the presence of large, immature, abnormal red blood cell progenitors in the bone marrow due to impaired DNA synthesis”

Mostly caused by deficiency of :

- Folic Acid (vitamin B<sub>9</sub>)
- Cobalamin (vitamin B<sub>12</sub>)



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# Recommendation

- **Folic Acid (Vitamin B<sub>9</sub>):**

Adult: 400 mcg

Pregnant females : 600 mcg

- **Cobalamin (Vitamin B<sub>12</sub>):**

Adult men and women 2.4mcg/d



# Diagnosis of Folate Deficiency

- Folate stores are depleted after 2-4 months on deficient diet
- Megaloblastic anemia, low leukocytes and platelets
- To differentiate from B12, measure serum folate, RBC folate (more reflective of body stores)
- Serum B12

# Causes of Folic Acid Deficiency

## Inadequate diet

- Poverty, alcohol, elderly, overcooked vegetables

## Increased demand

- Pregnancy, or increased cell turnover (malignancy, inflammatory disease, renal dialysis)

## Mal absorption

- Celiac disease , tropical sprue

## Drugs

- Antileptics, methotrexate, certain antibiotics etc.

## Vitamin B12 deficiency

- Circulating form of folate remains metabolically inactive



# Management of B<sub>9</sub> Deficiency

- Oral folic acid supplementation is required for 2-3 weeks to replenish stores
- Maintenance of replenished stores 50-100mcg daily
- Alcoholics or conditions with increased requirements or reduce absorption need 500-1000mcg daily



# Food sources of Vitamin B<sub>9</sub>

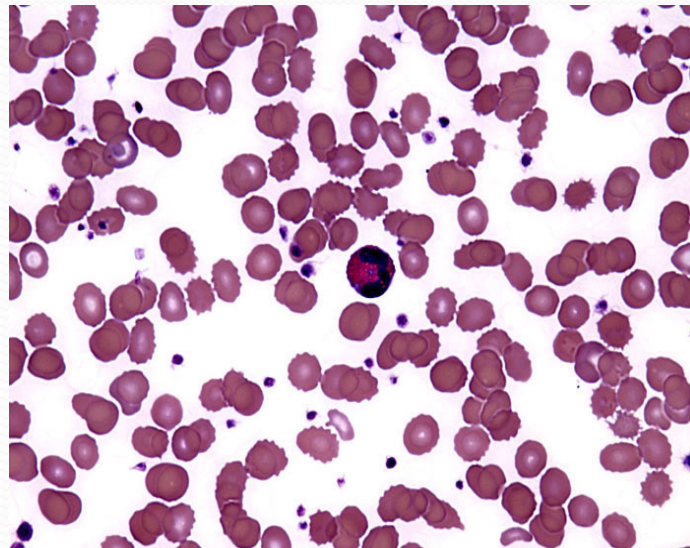
Folic Acid deficiency is prevented and treated by eating a healthy diet.

- Leafy green vegetables
- Yeast
- Lentils and beans
- Cereals
- Liver
- Nuts
- Dairy
- Meat



# Pernicious Anemia

**“Pernicious anemia is a type of megaloblastic anemia caused by an inability to absorb vitamin B<sub>12</sub> due to a lack of intrinsic factor in gastric (stomach) secretions.”**





# Laboratory Investigations For B12 Deficiency

- Serum B12
- Schilling test
- Methylmalonic acid measurements
- Homocysteine levels



# Causes of B12 Deficiency

## Inadequate diet

- Strict vegetarian diet , Poverty, Alcohol

## Mal absorption

- Gastrectomy , ileal resection, parasitic infections , Small Intestine Bacterial Overgrowth and digestive conditions like Crohns, Celiac

## Hypochlorhydria

- H.pylori, peptic ulcer disease, chronic gastritis and reduced production of IF

## Old age

- Atrophic gastritis, pernicious anemia

## Drugs that inhibit B12 absorpt

- Metformin, PPI, H<sub>2</sub>Receptor or other antacids, neomycin

# Signs of B12 Deficiency

## General:

- Angular
- Cheilosis
- Pallor
- Glossitis

## Neuropsychiatric:

- Depression
- Irritability
- Psychosis
- Dementia

## Neurological:

- Parasthesia
- Peripheral neuropathy

# Other adverse effects

- Vitamin B12 deficiency is an important modifiable risk factors for osteoporosis. Adults with lower vitamin B12 levels have a lower average bone mineral density and greater risk for osteoporosis (*Tucker et al. 2005*)
- B12 –folate –homocysteine interactions aggravate heart disease and may lead to adverse pregnancy outcomes (*Moreiras et al. 2009*)



# Management of B<sub>12</sub> Deficiency

- Treatment consists of vitamin B<sub>12</sub> 1000 ug intramuscularly (IM)
  - Daily for 7 days,
  - Weekly for 1 month,
  - Monthly for life unless the underlying etiology is corrected



# Management of B<sub>12</sub> Deficiency

Vitamin is found in animal-derived products, particularly in:

- Eggs
- Chicken
- Fortified cereals (especially bran)
- Red meats (especially beef)
- Milk
- Shellfish

# Other factors

## Vitamin A Deficiency

- Important part in erythropoiesis, improves hemoglobin concentration and increase efficacy of iron supplementation\*

## Copper Deficiency

- Ceruloplasmin, a copper containing protein is required for normal mobilization of iron from its storage sites

## Zinc Deficiency

- A lack of zinc can interfere with copper and iron intake triggering anemia (Kelkitli E et al.)

## Soil transmitted Helminthes

- Disease caused by soil – transmitted nematodes inhabit the GIT , loss of appetite, impaired digestion, malabsorption, poor growth rate and effects physical fitness\*

## Hook worm

- Cause chronic intestinal blood loss that can result in anemia.
- Worms increase malabsorption of nutrients.
- Roundworm may possibly compete for vitamin A in the intestine\*

## Malaria

- In malaria endemic regions iron supplementation may increase the risk of malaria & death  
\*(Determinants of Anemia in south East Asian Countries Radhika et al.)



# Strategies to improve anemia

Homestead food production model contributes

to improved household food security and nutrition status

## Punjab, DFID's food fortification project

By A Reporter

LAHORE: Punjab food department in collaboration with the UK Department for International Development (DFID) has launched Food Fortification Programme to improve nutrition of people in Pakistan, especially women and children.

The programme's launching ceremony was held at a local hotel on Thursday.

The programme will work closely with the communities and the government at all levels, including the Pakistan Flour Mills Association (PFMA), Pakistan Vanaspati Manufacturers Association (PVMA) and the Pakistan Standards and Quality Control Authority (PSQCA).

Pakistan has a high burden of

malnutrition and is facing health and economic consequences due to under nutrition. The National Nutrition Survey of Pakistan (2011) found that a majority of children and women in reproductive age suffered from multiple micro-nutrient deficiencies. Large-scale food fortification, the addition of small amounts of vitamins and minerals to staple foods, is one of the globally recommended successful strategies to address micro-nutrients malnutrition.

In order to combat micro-nutrient malnutrition in Pakistan, a five-year programme funded by the DFID has been started for fortification of wheat flour and edible oil/ghee produced in local mills. The programme is being implemented by Mott MacDonald and Nutrition International, in collaboration with key government departments and

with industry associations like the PFMA and the PVMA.

The programme will provide support to the industry to adequately fortify wheat flour and edible oil/ghee in Pakistan, the government to improve the food fortification regulatory system, raise awareness of the benefits of fortified wheat flour and edible oil and ghee and generate evidence to support the formulation of relevant policies to combat micro-nutrient deficiencies here.

DFID-Pakistan Head Joanna Reid on the occasion said more than 3.5 million women were not receiving proper nutrition and 2/3 percent of them were facing Vitamin A and D deficiency.

She regretted that nearly half of all children under five in Pakistan were chronically malnourished. She said children were more vul-

nerable to diseases due to malnutrition and it affected their mental and physical development and leads to lifelong learning, memory deficiencies and poor achievement at school.

She said that malnutrition also affected the economy of the country by increasing poverty around 2-3 percent of its GDP. Provincial food minister Bilal Yaseen said they were closely working with the UK aid to control vitamin A and D deficiency.

He said fortification of wheat flour with iron and folic acid and edible oil with vitamin A and D would help us reduce the hidden hunger in our population.

Provincial minister for social welfare Ms Zakia Shahnawaz said most of the women and children from south Punjab were facing malnutrition.

among program households, with liver consumption increasing from 24% at baseline to 46% at endline and the median number of eggs consumed by families per week increasing from 2 to 5. The sale of HFP products also improved household income. Anemia prevalence among children in program households decreased in all the countries; however, the decrease was only significant in Bangladesh and the Philippines. Although anemia prevalence also decreased among control households in three countries, the magnitude of change was higher in program households compared with control households



Thank you!

