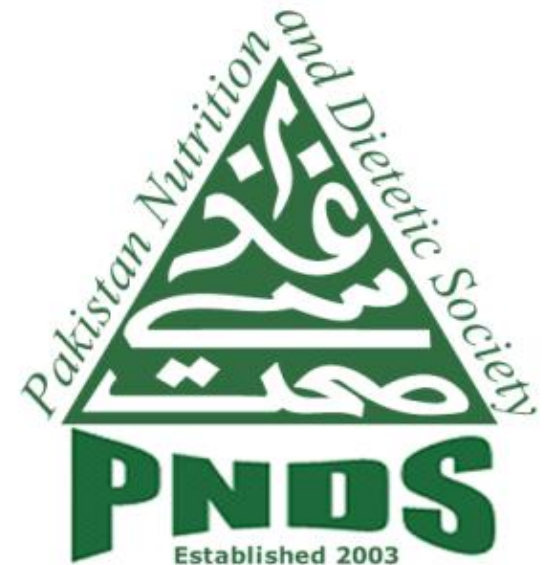


# Nutritional Anemia

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# Overview

- Definition
- Prevalence
- Causes
- Symptoms
- Clinical and laboratory diagnosis
- Nutritional Anemia
  - IDA
  - B12
  - Folate



# Definition

Anemia is a deficiency in the size or number of red blood cells (RBCs) or in the amount of hemoglobin they contain. This deficiency limits the exchange of oxygen and carbon dioxide between the blood and the tissue cells.

*Krause's Food & Nutrition Therapy 13<sup>th</sup> edition by Mahan & Sylvia, 2012*



# Prevalence

The global prevalence of Anemia for the general population is 24.8%.

- It is estimated that 1620 million people are affected by anemia.
- National Nutrition Survey 2011.
  - Women of Child Bearing Age 50.5%
  - Pregnant Women 51%
  - Children 62.1%

*[who.int/vmnis/database/anaemia](http://who.int/vmnis/database/anaemia)*



# Causes

- Lack of required nutrients.
- Loss of blood.
- Chronic Disease.
- Genetic Abnormalities.
- Inadequate production of red blood cells.





# Symptoms

- Weakness, fatigue.
- Loss of appetite, anorexia.
- Decreased work performance.
- Dizziness.
- Hypoxia (shortness of breath).
- Bruising .
- Pica.



# Symptoms

- Skin: Pale.
- Eyelid: Inside lower eyelid light pink.
- Fingernails: thin , flat eventually koilonychia (spoon shaped nail).
- Tongue: Glossitis (completely smooth waxy glistening appearance).





# Laboratory Tests

- CBC (complete blood count)
  - Hemoglobin level.
  - Red blood cell count.
  - Hematocrit.
  - Blood smear.
  - Leukocyte & platelet count.
  - Reticulocyte count.

Tourniquet is applied and area is disinfected



Needle is introduced into vein, blood is drawn into vial and analyzed



ADAM.





# Hemoglobin(Hb)

Diagnostic Criteria	
Age(years)	g/dL
Children 6 months to 59 months	11
Children 5–11 years	11.5
Children 12–14 years	12
Non-pregnant women (above 15 years of age)	12
Pregnant women	11
Men (above 15 years of age)	13

## WHO cut off for Normal Hemoglobin



# Anemia Assessment of Severity

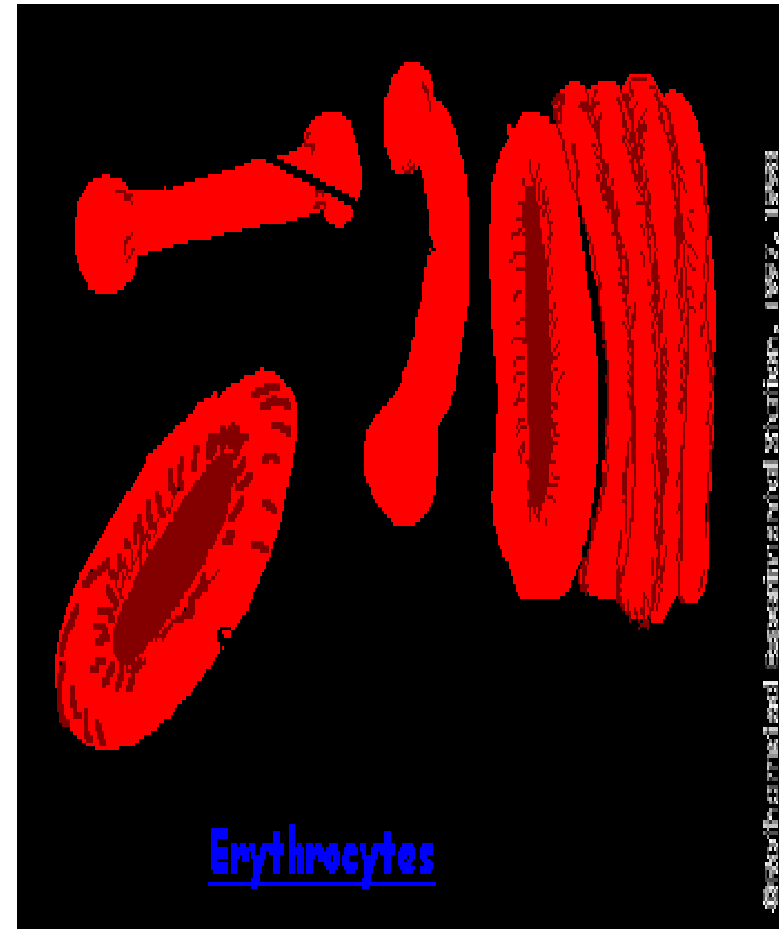
Population	Mild	Moderate	Severe
Children 6 - 59 months of age	10.0-10.9	7.0-9.9	lower than 7.0
Children 5 - 11 years of age	11.0-11.4	8.0-10.9	lower than 8.0
Children 12 - 14 years of age	11.0-11.9	8.0-10.9	lower than 8.0
Non-pregnant women (15 years of age and above)	11.0-11.9	8.0-10.9	lower than 8.0
Pregnant women	10.0-10.9	7.0-9.9	lower than 7.0
Men (15 years of age and above)	11.0-12.9	8.0-10.9	lower than 8.0

**WHO Hemoglobin concentrations for the diagnosis of anemia and assessment of severity**



# Red Blood Cells(RBCs)

- Function: Delivery of oxygen to tissues in the body.
- Life: about 120 days.
- Also called Erythrocyte.
- Normal RBC level.
  - (M): 5.4 +/- .8 million/ uL
  - (F): 4.8 +/- .6 million/ uL





# Blood Smear

- Microcytic

RBCs volume < 80 fl oz. (small RBC's) MCV < 80;MCHC < 31

Hb content indicated by mean corpuscular hemoglobin (MCH)

- Normocytic

RBCs volume 80-99 fl oz. (normal RBC's) MCV 82-92 ;MCHC >30

Mean Cell hemoglobin Conc (MCHC) is the measure of conc of Hb in the average RBC

- Macrocytic

RBCs volume > 100 fl oz. (Large RBC's) MCV >91;MCHC >31



## Other Laboratory Tests

- Microcytic Anemia.
  - Serum iron, total iron binding capacity(TIBC), serum ferritin are measured.
- Macrocytic Anemia.
  - Static tests for folate, vitamin B12 are taken
  - Homocysteine levels are measured.



# Types of Anemia

- Microcytic Anemias/hypochromic
  - Iron Deficiency Anemia
  - Copper Deficiency Anemia
  - Thalassemia
- Normacytic Anemia/Normochromic
  - Aplastic Anemia
  - Anemia of Chronic Disease
  - Inherited Anemia
  - Hemolytic Anemia
- Macrocytic Anemia/hyperchromic
  - Pernicious Anemia
  - Folic Acid Deficiency
  - Refractory Anemia



# Types of Nutritional Anemia

- Iron Deficiency Anemia (IDA).
  - Maternal anemia
- Pernicious Anemia (B-12 Deficiency).
- Folic Acid Deficiency anemia.



# Persons at Greatest Risk of Nutritional Anemia

## Inadequate Intake

- Vegetarian, chronic alcoholism, poverty.

## Inadequate Absorption

- Diarrhea, intestinal diseases eg. celiac disease, atrophic gastritis, partial or complete gastrectomy, HIV or AIDS.

## Increased Requirement

- Infancy , adolescence, pregnancy and lactation.

## Increased excretion

- Excessive menstrual blood, hemorrhage from injury, chronic blood loss from a bleeding ulcer, bleeding hemorrhoids, parasites (hook worm disease) or malignant disease.





# Iron Deficiency Anemia ( IDA)

- The most common type of Anemia.
- Iron deficiency is ranked at the top of three global “hidden hungers” (Iron, Iodine & Vit A)
- National Nutrition Survey Pakistan-2011
  - Pregnant women 25%
  - Non pregnant women 19.9%
  - Children 33..4%

*National Nutrition Survey of Pakistan-Report AKU ; 2011*



# Dietary Reference intake for Iron

Age (years)	Males/female mg/day
1-3	7
4-8	10
9-13	8
14-18	11 For males 15 for females
19+	8 for males 18 for females
Pregnancy	14-18 year 27 +19 year 10
Lactation	14-18 year 27 +19 year 9

*Krause's Food & Nutrition Therapy 13<sup>th</sup> edition by Mahan & Sylvia, 2012*



## Bioavailability of Dietary Iron

- It is estimated that 1.8 mg iron must be absorbed daily to meet the need.
- The rate of absorption depends on the iron status of the individual.
- Form of iron in the diet also influences absorption.
  - Heme iron: 15% absorbable  
present in meat, fish and poultry (MFP), is much better absorbed than
  - Non heme iron: 3% to 8% absorbable  
present in eggs , grains, vegetables and fruits.



# Sources of Iron

	<b>Food</b>	<b>Portion size</b>	<b>Iron (mg)</b>
1	Liver (chicken )	3 oz	7.2
2	Liver(beef)	3 oz	5.8
3	Chicken,(dark meat)	3 oz	1.2
4	Rice	1 cup (cooked)	1.8
5	Chick pea	½ cup	2.4
6	Kidney beans	½ cup	2.6
7	Lentils beans	½ cup	3.3
8	Cashew nuts	1 oz	1.7
9	Pistachio nuts	1 Oz	1.9
10	Soy milk	1 cup	1.8
11	Peaches (dried )	5 halves	2.6
12.	Prune juice	1 c	3.0
13	Spinach	1 cup	1.5
14.	Baked potatoes	1 medium	2.7
15.	Whole wheat bread	1 slice	1.0



# Iron absorption Enhancers

- **Vitamin C** rich foods along with high iron meals.
- An intervention study: 3 meals a day with lemon included in daily diet, increased average Hb 5.8-9.5 g/dl.
- Including some amount of heme containing **MFP** in cooking of non-heme sources.
- Fermentation of Flour (Atta )
- **Beta-Carotene** increases absorption of metal. In presence of phytates or tannic acid, beta-carotene overcomes inhibitory effects of both compounds depending on their concentrations.

Kapdia-Kundu ,2003



# Sprinkles

Sprinkles are

- sachets (like small packets of sugar) developed by Global Health Association to prevent and treat micronutrient deficiencies.
- contain a blend of micronutrients in powder form, which can easily be sprinkled into foods prepared at home.
- In Bangladesh, among 70 anemic young children 12-24 months old given Sprinkles for 2 months, mean hemoglobin increased from 9.7 g/L to 11.3 g/L.



# Framingham Heart Study

- **Participants:** Over 600 elderly patients.
- **Results:** Those who took supplemental iron along with fruit had higher iron stores
- **Conclusion:** Eating fruits or adding honey or black-strap molasses to foods such as cereals can boost iron absorption.

[www.irondisorders.org](http://www.irondisorders.org)



# Iron Inhibitors

- **Carbonates:** Tea and coffee ( formation of insoluble iron compound with tannin).
- **Phytates fiber** rich food: unleavened bread, bran, unrefined cereals & soybeans.
- **Egg yolk** iron is poorly absorbed due to Phosphoprotein called phosvitin.
- **Oxalates** impair the absorption of nonheme iron and found in foods such as spinach, beets, nuts, chocolate, Tea, wheat bran.
- **Calcium** in amounts 300-600 milligrams inhibit the absorption of heme iron similarly to nonheme iron.





# Maternal Anemia



- Inadequate documentation of anemia's effects on maternal mortality, morbidity, on infant health and development.
- maternal iron deficiency anemia increases the risk of preterm delivery and subsequent low birth weight.
- In a study of 44,000 pregnancies ,it was found that there is an association between low maternal hemoglobin concentration and poor pregnancy outcomes. The risk of preterm delivery was doubled.

Scholl & Reilly (2000)-

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# Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan

- **Study design & sample** : Prospective , observational study of 1,369 pregnant women enrolled at 20 to 26 weeks of gestation and followed to 6 weeks postpartum.
- **Methods** : Blood sample for HB and Information on nutritional knowledge, attitudes, practice and dietary history before and during pregnancy were obtained.
- **Results** :
  - High prevalence of anemia ( 90.5%).
  - **Never consuming eggs** or consuming eggs **less than twice a week** during pregnancy (aPOR, 1.7; 95% CI, 1.1 to 2.5) were significantly associated with anemia.
  - **Consumption of red meat less than twice a week** prior to pregnancy was marginally associated with anemia(aPOR, 1.2; 95% CI, 0.8 to 1.8) but was significantly associated with lower mean hemoglobin concentrations.



# Pernicious Anemia (Vitamin B<sub>12</sub>)

- Inability to absorb vitamin B<sub>12</sub>
- For the absorption of dietary vitamin B<sub>12</sub> Intrinsic factor(IF) is necessary, IF is a glycoprotein in the gastric juices secreted by parietal cells of the intestinal mucosa.
- Body stores are sufficient till 4 years of age .
- Pernicious anemia affects not only the blood but also the gastrointestinal tract and the peripheral and central nervous systems, this distinguishes it from folic acid deficiency anemia.



# Factor Affecting of vitamin B<sub>12</sub> Anemia

- For those individuals prescribed metformin for treatment of diabetes, vitamin B<sub>12</sub> absorption can be reduced up to 30%.
- *Helicobacter pylori* bacterium affects about 10% to 15% of men and women and can cause B<sub>12</sub> deficiency.
- Turkish Military Academy studied 138 patients with vitamin B<sub>12</sub> deficiency anemia and found that 77 (58%) had *H.pylori* infection. Treating the infection corrected the anemia and normalized the serum B<sub>12</sub> levels in 31 (40%).



## Dietary Reference Intakes for vitamin B<sub>12</sub> for Children and Adults

Age (year)	Males and females (mcg)	Pregnancy	Lactation
1-3	0.9	N/A	N/A
4-8	1.2	N/A	N/A
9-13	1.8	N/A	N/A
14-18	2.4	2.6	2.8
19 or older	2.4	2.6	2.8

*Krause's Food & Nutrition Therapy 13<sup>th</sup> edition by Mahan & Sylvia, 2012*



# Vitamin B<sub>12</sub> Content of common foods

S.No	Food	Portion size	B <sub>12</sub> (mcg)
1	Chicken	3 oz	0.3
2	Liver chicken	3 oz	16.5
3	Sardines	3 oz	7.7
4	salmon	3 oz	5.8
5	Egg	1 whole	0.5
6	Milk	1 cup	0.9
7	Yogurt	1 cup	1.4
8	Cottage cheese	1 oz	0.6
9	Mozzarella	1 oz	0.5
10	Fortified breakfast cereals	¾ cup	6

*Krause's Food & Nutrition Therapy 12<sup>h</sup> edition by Mahan & Sylvia, 2012*



# Treatment

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



# Folic Acid Deficiency Anemia



- Folate is easily destroyed by sunlight, overcooking, storing for extended periods.
- Fresh uncooked fruits and vegetables are good sources of folate.
- Folic acid and B12 have interrelated role in synthesis of DNA and RNA.
- Deficiency of B<sub>12</sub> can lead to folic acid deficiency .



# Folic Acid Deficiency Anemia

- Folic acid deficiency in early pregnancy can result in an infant with neural tube defect.
- Certain drugs can interfere with the action of folate in the body. They include anticonvulsant drugs, antibiotics like tetracycline, and sometimes, drugs used in the treatment of tuberculosis.
- Healthy adults with low intakes of folate and b12 scored poorly on memory tests compared to those with adequate intakes.

• (martha paul 2007)



# Dietary Reference for Folate for Children and Adults

Age (years )	Males and female (mcg/day)	Pregnancy (mcg/day )	Lactation (mcg/day)
1-3	150	N/A	N/A
4-8	200	N/A	N/A
9-13	300	N/A	N/A
14-18	400	600	500
19 +	400	600	500

*Krause's Food & Nutrition Therapy 13<sup>th</sup> edition by Mahan & Sylvia, 2012*



# Content of common foods

S.No.	Food	Portion size	Folate (mcg)
1	Chicken	3 oz	30
2	Liver chicken	3 oz	675
3	Sardines	3 oz	21
4	Egg	1 whole	0.5
5	Milk	1 cup	13
6	Yogurt	1 cup	28
7	Cottage cheese	1 oz	10.8
8	Apricots	3 raw	9.1
9	orange	1	40.0
10	Orange juice	1 cup	136.0
11	Banana	1	22
12	Spinach	½ cup	108.0
13	broccoli	1 cup	62

*Krause's Food & Nutrition Therapy 12<sup>h</sup> edition by Mahan & Sylvia, 2012*



Thank you