Information about Ca and Fe

MINERAL

Minerals are one of the six essential nutrients for life. The difference between minerals and organic substances of the body is that minerals do not contain carbon atoms in their structure, however it is often combined with carbon - contained in organic substances when performing functions in the body. .

To date, there are many minerals known to nutritional science. There are 92 substances in the periodic table that participate in biological functions. The following are minerals that are well known in terms of their structure, complexes and functions in the human body as well as in foods.

Minerals are divided into two main groups: macronutrient minerals, which include substances present in the body with amounts from 0.005% to <1% of body weight (except calcium, which accounts for 1.5-2%).) and requires a great deal of food; micronutrient minerals, including those that exist in the body in amounts less than 0.005% of body weight and require smaller amounts.

CALCIUM - Ca

Calcium helps the body form strong bones and teeth, ensure nerve function and normal blood clotting. All metabolic processes in the body require calcium.

Distribution:

Calcium accounts for 1.5-2% of body weight, about 1200 to 1600g in an adult male weighing 80kg. About 99% of calcium is found in tooth and bone tissue. The remainder is distributed in soft tissues, blood, liver and heart. Half of the calcium in the blood exists in the form of soluble $Ca2+$ ions, about 40% bound to proteins, 7-10% in low molecular weight ion complexes such as citrate, calcium, calcium phosphate.

Although 99% of calcium is distributed in teeth and bones, only a small amount of calcium is outside the cells, but they have a vital role in the body. The importance of calcium in the soft tissues and blood is reflected in the serum calcium concentration being maintained within a narrow range of 9-11 mg/dL, rarely fluctuating above 3%. One of the major factors in stabilizing plasma calcium levels is that bone calcium is mobilized when blood calcium is reduced.

CA Function: Create bone

Osteogenesis is initiated very early from conception and creates a dynamic pattern. This mold takes up 1/3 of the structure of the bone and remains very soft until birth, making it easier for the baby and mother during childbirth. This skeleton is composed of the fiber of a protein called collagen, which is covered by a gelatin complex of proteins and polysaccharides called the matrix. After birth, the skeleton becomes longer and wider, quickly solidifying due to the deposition of minerals into the bone. This process is called calcium or ossification because the hardener and the most abundant mineral in the complex is calcium. By the time a child can walk, the skeleton has calcified enough to support the body weight.

The mineral crystals that are gradually deposited during the ossification process are calcium phosphate, Ca3(PO4)2, called apatite; or a mixture of calcium phosphate and Ca(OH)2 -

hydroxyapatite. Since Ca and P are the major minerals in bone, an adequate supply of these two minerals during growth is essential.

CA Function: Create teeth

The outer and middle parts of the tooth are called enamel, and the bone contains a very large amount of hydroxyapatite, which is present along the length of the protein keratin (collagen in bone). On the other hand, the hydroxyapatite crystals in bone are denser and contain less water than in bone. The first teeth to erupt are called baby teeth, which are gradually replaced by permanent teeth at the age of 5-10 years. The process of calcification of milk teeth begins at about 20 weeks of gestation) and is completed only before eruption (when the child is 6 months old). Permanent teeth begin to be calcified when children are from 3 months old to 3 years old, right when they are still in the process of creating baby teeth. Wisdom teeth, which are the last teeth to erupt, begin to calcify at the age of 8-10 years. Whole adult teeth make up about 1% of the total calcium in the body's hard tissues.

There is a slow exchange of calcium between blood and crown, possibly between salivary calcium and enamel calcium. Lack of calcium in the process of tooth formation can lead to the risk of tooth decay. Although calcium is the most important ingredient in tooth formation, it is important to note that the quality of teeth depends on many other factors.

Development and growth

Calcium is essential for growth, is a basic component of bones and teeth. Some studies in Japan show that diets low in calcium are often associated with short height. A diet low in calcium is often associated with low protein, an important factor for body growth and bone development. The mechanism by which hypocalcaemia is the direct cause of growth retardation has not been determined, but it is probable that calcium is a contributing factor.

Cofactors regulating biochemical reactions

The role of calcium in blood clotting is a well known function. When tissue is injured, the enzyme thromboplastin is released from damaged cells or from platelets. This enzyme catalyzes the conversion of the protein prothrombin in the blood to thrombin, a process requiring the presence of calcium. Thrombin is an enzyme that converts the blood-soluble protein fibrinogen into fibrin, an insoluble fibrin system that is the basic structure of blood clots. The plasma calcium concentration is maintained within a narrow range to allow the fastest blood clot contraction. People who have enough calcium in their daily diet do not need to increase calcium before surgery.

The role of calcium in blood clotting is just one example of the cofactors that regulate biochemical reactions. Other roles are calcium's role in nerve impulse transmission, in vitamin B12 absorption; on pancreatic enzyme activity in fat digestion; during muscle contraction. Calcium has dozens of different important functions, but changes in calcium in the diet are often less effective early on because of maintaining the calcium balance of the bones.

Effects of calcium deficiency and excess

- Calcium deficiency

The human body needs calcium, especially for children, women, the elderly. Lack of calcium in the diet, poor absorption of calcium and/or excessive loss of calcium lead to bone mineralization disorders.

Chronic calcium deficiency (due to poor absorption of calcium in the small intestine, due to insufficient calcium in the diet...) is one of the important causes leading to decreased bone density, osteoporosis in adults and rickets in children. em.

Osteoporosis is a reduction in bone mass, increased fragility, and an increased risk of fracture. According to some recent studies, the rate of osteoporosis in postmenopausal women in Vietnam ranges from 30-40%. The risk of osteoporosis can appear from the age group 35-40 and increases with age.

Rickets in children occurs when the amount of calcium per unit volume of bone is deficient. Low blood levels of free calcium ions (hypocalcaemia) can lead to muscle spasticity, a condition in which the muscles twitch.

When calcium in the blood decreases, the body must mobilize calcium from the bones into the blood to participate in metabolic processes, causing symptoms of pain in the bones, especially the long bones in developing children, and can also cause serious health problems. Insomnia, hot temper. In addition, long-term dietary calcium deficiency is associated with the development of high blood pressure and bowel cancer.

- Excess calcium

When calcium intake is in excess, calcium will be excreted from the body, so it is very rare for cases of excess calcium in the blood or excess storage in tissues due to excessive calcium consumption. However, long-term use of high doses of calcium drugs can lead to kidney stones (nephrolithiasis), high blood calcium (hypercalcaemia), poor kidney function, and decreased absorption of other essential minerals (eg, iron, zinc). , magnesium and phosphorus, iodine, copper).

<u>Food sources of calcium in the daily diet</u>

Foods rich in calcium include milk, cheese, other dairy products, dark green vegetables, bean products (eg tofu), and edible fish with bones. Recently, in some countries, many calcium-fortified products have appeared on the market such as bread, biscuits, orange juice, instant cereals.

Unlike in Western countries, where the food source of calcium is dairy products, in Southeast Asian countries the important sources of calcium are bean products, cereals, green vegetables and fruits. fish.

We don't have a lot of calcium-fortified foods. In the current conditions, to meet calcium needs, in addition to fish products, beans, green vegetables and cereals, try to use milk and dairy products (cheese, yogurt), especially for dairy products. children and people at risk for osteoporosis. However, when consuming a lot of calcium-rich foods or taking anti-osteoporosis drugs, it is important to drink enough water to prevent kidney stones.

<u>Absorption and influencing factors</u>

The average rate of calcium absorption from food in adults is about 30%. In subjects with high calcium requirements such as children in the growing age, pregnant and lactating women, after bone fractures... the absorption rate can be up to 50%. Because calcium absorption is very complex and influenced by many factors, it is necessary to consider bioavailability, i.e. the absorption rate of calcium in that food when deciding to choose a food. source of calcium for the body.

Percentage of calcium absorbed from some calcium-rich foods

Thực phẩm	**Phần ăn** (serving size)	**Lượng Calci/ phần ăn** (mg)	**Tỉ lệ hấp thu (%)**	**Lượng calci vào máu** (mg)
Yaourt tách béo	240 ml	488	32	156
Sữa 2% béo	1 cup	314	32	100
Sữa tách béo	1 cup	306	32	98
Rau cải xoăn	1 cup	179	59	106
Củ cải xanh	1 cup	197	52	103
Bông cải xanh	1 cup	61	61	37
Bông cải trắng	1 cup	20	69	14
Rau bó xôi	1 cup	291	5	14

Sources of calcium supplemented from calcium products are also considered as a measure to meet calcium requirements in the daily diet. For calcium supplements, the salt base in the calcium compound is related to the absorption rate: calcium bound to inorganic radicals (carbonate, phosphate) will be less absorbed than calcium bound to radicals. organic (lactate, citrate, gluconate) (table 1.11). The absorption rate of these preparations is often inferior to that of calcium in natural foods, so it should be taken at the same time as a mixed meal to increase the ionization and absorption of calcium, and the amount of calcium supplement is usually not should exceed 500mg each time.

Ratio of elemental calcium, absorption capacity and cost of calcium salts used in calcium supplements

Calcium Salt	**% Elemental Calcium**	**Degree of absorption**	**Price**
Carbonate	40	+	Cheaper
Phosphat	38	+	Cheaper
Citrate	21	+	Medium
Lactate	13	++	More expensive
Gluconate	9	++	More expensive

Factors that enhance and inhibit calcium absorption

Factors that increase calcium absorption	**Factors that decrease calcium absorption or increase calcium loss**
Vitamin D Acids in the digestive system Lactose Proteins and Phosphorus Necessities	Oxalic acid; phytic acid Sweat a lot Mentally unstable Increase intestinal motility Lack of physical activity Dietary fiber Caffeine, stimulants

<u>Recommended calcium requirement</u>

Calcium requirements for the body are determined in correlation with phosphorus: the desired Ca/P ratio is at least > 0.8 for all ages, preferably 1-1.5 (especially for with children). According to the recommendation of the American Institute of Medical Research (IOM, 2011), and also refer to the studies in Vietnamese and Asian countries (Japan, Malaysia, Singapore...), the recommended level of nutritional needs Calcium (mg/day) by age, sex and physiological status are as follows:

Recommended calcium requirement (mg/day)

Month/year of age	***RDA***	***UL***	***RDA***	***UL***
0-5 month	300	1000	300	1000
6-8 month	400	1500	400	1500
9-11 month	400	1500	400	1500
1-2 year	500	2500	500	2500
3-5 year	600	2500	600	2500
6-7 year	650	2500	650	2500
8-9 year	700	3000	700	3000
10-11 year	1000	3000	1000	3000
12-14 year	1000	3000	1000	3000
15-19 year	1000	3000	1000	3000
20-29 year	800	2500	800	2500
30-49 year	800	2500	800	2500
50-69 year	800	2000	900	2000
>= 70 year	1000	2000	1000	2000
Pregnant	1200	2500		
Breastfeeding	1300	2500		

IRON - Fe

It is the fourth most abundant substance on earth, accounting for 4.7% of the earth's crust. Isn't it surprising that iron is so abundant, yet iron deficiency anemia is very common in countries? Iron has been known to be an important component of the body since 1713. In 1800, Lecanu identified in the composition of hemoglobin (Hb), which plays a role in oxygen transport. The human body contains about 2.5-4g of iron, depending on gender, breed, age, body size, nutritional status and iron stores.

Distribution

Iron is found in all cells, most commonly in the blood, where it is usually bound with enzymes that contain iron. Iron in the body can be divided into functional iron, which is involved in biochemical functions of the body, and non-functional iron, which is stored or transported in the body. Functional iron accounts for over two thirds of the total, most of which is in the composition of Hb, a small part is attached to myoglobin, with metalloenzymes involved in catalytic reactions of the cell.

Most of the non-functional iron is stored in the liver, spleen, and bones. Some are attached to ferritin, each of which contains 4,500 iron ions (Fe^{3+}). Ferritin is the circulating storage form of iron, the non-circulating storage form is Hemosiderin. The form of body iron stores varies from person to person, in men (about 1000mg), in women (about 400mg). Iron can be rapidly exchanged from a non-circulating form to a bound form with circulating proteins.

Function

Oxygen transport and storage

Iron (Fe^{2+}) in hemoglobin (Hb) and myoglobin can bind with molecular oxygen (O_2), then transfer them into the blood and store in the muscle. Iron does not bind to these proteins directly, but via the Hem nucleus. Each Hb molecule is attached to 4 oxygen molecules. Hb is present in red blood cells and gives red blood cells their red color. When red blood cells reach the lungs, they release CO_2 and receive O_2, and then provide O_2 to the body's tissues. Myoglobin has only one oxygen-binding pole and thus each myoglobin molecule is bound to only one oxygen molecule. Myoglobin is only found in skeletal muscle, they act as a place to store oxygen for activity, they will combine with nutrients to release energy for muscle contraction.

Cofactors of enzymes and proteins

Heme iron participates in a number of proteins, plays a role in the release of energy in the oxidation of nutrients and ATP. Iron also binds to a number of non-heme enzymes, which are required for cell function. Several other processes also depend on iron-containing enzymes as follows: the conversion of beta-carotene to vitamin A; synthesis of purines, components of DNA and RNA; synthesis of carnitin, a vitamin-like substance needed for fatty acid transport; synthesis of collagen, an important structural component of the body; detoxification of certain drugs and toxins for the liver and intestines; Synthesis of neurotransmitters, dopamine, serotonin and norepinephrine.

Create red blood cells

The hemoglobin of red blood cells contains iron, an important component for red blood cell function. The process of differentiation from immature bone marrow cells to mature red blood cells requires iron. It takes 24 to 36 hours for cells to leave from the interstitium to mature erythrocytes.

Because red blood cells do not have a nucleus, they cannot produce the enzymes and active substances needed to prolong life. They can only live for about 120 days (4 months). When red blood cells die, they are transferred to the liver, bone marrow, and spleen, called the reticuloendothelial system. In the spleen, iron and protein from dead red blood cells are reused. Iron is stored in ferritin, and hemosiderin in the liver and spleen is transferred to the bone marrow to make new red blood cells. The remainder of the Hb is used to make bilirubin, transported to the liver, and excreted in the bile.

Absorption and influencing factors

Iron absorption

Occurs mainly in the jejunal part of the small intestine. There are two forms of iron that can be absorbed by different mechanisms. Non-heme iron, which is not attached to the heme part, is present mainly (accounting for 85%) in plant foods, in the form of $Fe2+$ or $Fe3+$. The form of heme iron, which binds to the heme nucleus, is found in foods from animal sources of hemoglobin and myoglobin.

To be absorbed, non-heme iron must be removed from food in the upper small intestine into a soluble form, which is then bound to a transferrin-like transport protein, which crosses the intestinal parietal cell membrane. The process of releasing iron to its free form in the intestine before it is absorbed is highly dependent on a number of factors that can inhibit or enhance the presence of food.

Absorption rates of non-heme iron can range from 1% to 50%, which is inversely proportional to dietary iron: for example, absorption decreases from 18% to 6.4% when dietary iron intake is increased from 1.5 mg to 5.7mg. Absorption is more effective in people with iron deficiency. Heme iron is transferred through the intestinal parietal cells still in the form of heme. There are specific receptors in the intestinal parietal cells that help with this absorption. When Hem iron enters the intestinal parietal cells, it will be rapidly metabolized with the participation of the enzyme hemoxygenase. Iron is transferred to a common reserve in the cell. Because iron is bound to heme before it is absorbed into the intestinal wall, absorption of heme iron is independent of dietary factors, but animal protein increases absorption of heme. . Calcium reduces the transfer of absorbed iron from the intestine into the blood by inhibiting the transport of iron through the intestinal parietal cells rather than inhibiting the absorption of iron into the cells. The amount of heme iron in the diet has little effect on the absorption rate, always in the range of 20-25%.

Factors affecting non-Heme iron

a. Absorption enhancing factor Increases gastric acidity: by increasing the solubility of iron in the form of $Fe2+$, forming a soluble complex between iron and organic acids, which is considered an iron binding agent. Ascorbic, citric, lactic, malic, and HCl acids all increase iron absorption. Vitamin C has the most obvious effect, for example, when adding 25-30mg of vitamin C to the diet can increase iron absorption by up to 85%, or up to 15 times when high doses of 2g vitamin C are present. The effect of vitamin C is greater when in the diet less meat, fish ...

Animal source foods: meat, fish, poultry (containing muscle tissue) increase vitamin C absorption by 2 to 4 times. While proteins from eggs, milk, and cheese have no such effect. It can be explained that the amino acids cysteine released from peptides during digestion have combined with iron into a soluble form. With 1g of meat there is a strengthening effect equal to 1mg of vitamin C.

Absorption Inhibitors Decreases stomach acid for whatever reason reduces iron absorption. High fiber diets reduce iron absorption, however only with certain types of fiber, for example cellulose has no effect, while hemicellulose reduces absorption. Mechanism of malabsorption can increase the rate of food movement in the intestinal lumen and is often accompanied by phytate, a very strong inhibitor of iron absorption.

More calcium and phosphate in the diet, can reduce absorption by 50%. This effect is also dose dependent of calcium and phosphorus. Therefore, when taking calcium, it should be a few hours before or after meals or should not be supplemented with calcium and iron at the same time.

Phytates and oxalates are salts of phytic and oxalic acids, which combine with iron ions to form insoluble complexes. These substances are found in many plant-based foods such as cereals, beans, and some types of amaranth.

High dietary manganese inhibits iron absorption by competing for absorption in the intestine, because the two micronutrients have the same mechanism and pathway of absorption into the body.

Polyphenols, which are organic ingredients (well known as tannins) found in coffee, tea, coca and some other foods can reduce absorption by up to 70%, by forming insoluble complexes in the intestine.

Transportation and Transformation

Once absorbed, iron is transferred into the blood bound to transferrin. Each transferrin molecule can bind to 2 Fe^{3+} ions. Under normal conditions, less than 50% of the iron-binding sites of this protein are bound to iron. The blood also contains a reserve of iron attached to ferritin, a ferritin molecule can bind 4500 Fe^{3+}… Most of the iron stores are in the liver, spleen, bone marrow, a few are stored in ferritin.

The membranes of all cells in the body contain transferrin receptors (transferrin receptors), which can bind to two transferrin molecules and enter the cell together, then release iron in the cytoplasm. If the cell needs more iron, more receptors are produced to take in more iron. The placenta has many transferrin receptors, so the transfer of iron from the mother's blood to the fetus is done easily.

Recommended Diet

The amount of iron needs to compensate for the physiological loss

Because there is no mechanism to excrete iron, the amount of iron in the body is well preserved. However, there is still loss through urine, inhalation, skin, and feces. The largest amount is lost in the feces due to the death of intestinal parietal cells (0.7mg/day), other routes 0.2-0.5mg/day, total loss 0.9-1.2mg/day. Women also lose through menstruation (0.9-1mg/day).

Iron needed for body development

The growing body has an increase in both body mass and blood volume, both of which require iron supplementation for metabolic activities, red blood cell Hb, and muscle myoglobin. From birth to adulthood, the total amount of iron in the body increases from 0.5 to 5g. On average in 20 years of development, the body needs 225mg/year, or 0.6mg/day.

Iron needed for pregnancy

Pregnant women need iron for increased blood volume (450mg), for fetal development (50-90mg), to compensate for blood loss during childbirth. The total amount of iron needed for pregnancy is about 1040mg, of which 840mg is lost through the body's normal route, 200mg is needed for storage. On average in 9 months of pregnancy, the amount of iron needed daily is 3mg.

Sources of iron in food

Iron in food comes in two forms, heme or non-heme iron. The heme form is found in foods of animal origin, except eggs (such as phoscidin) and milk (such as lactoferrin). Heme iron can be readily absorbed from the intestine, while non-heme iron absorption depends on the presence of certain substances that increase or interfere with iron absorption. Ascorbic acid (vitamin C), animal protein and organic acids in fruits and vegetables increase the absorption of non-heme iron. Iron absorption inhibitors are commonly found in plant-based foods, such as the Phytate found in rice, grains, and legumes. Another inhibitor is tannin in some vegetables, tea and coffee. Therefore, the iron content of foods does not necessarily reflect iron adequacy in the diet. Iron requirements depend on the amount of iron that can be absorbed in the diet.

Sources of iron from Vietnamese food

Heme Iron		**Non-Heme Iron**	
Food Iron	Amount (mg%)	Food iron	Amount (mg%)
Cow blood	52,6	Rice	1,3
Pig oval	8,0	Wheat flour	2,0
Pork liver	12,0	Potato	1,2
Chicken	1,5	Cassava	1,2
Chicken liver	8,2	Green bean	4,8
Dried octopus	5,6	White beans	6,8
Yolk	5,6	Soybean	11

Sources of iron from animal foods such as lean meat, animal liver contain relatively high amounts of iron and are easily absorbed. Iron from plant sources also accounts for a high proportion, but is less absorbed than animal sources.

Food processing utensils, especially those made of iron or cast iron, have the potential to increase the amount of iron in the diet during processing and reduce the incidence of anemia.

A number of processed foods fortified with micronutrients, including iron such as nutritional powder, flour, fish sauce, instant noodles, etc., are also increasingly developed and are an important source of iron in the prevention of anemia in Vietnam. subjects at risk.

Iron plays a very important role in the body. Iron together with protein forms hemoglobin, transports O2 and CO2, prevents anemia and participates in the composition of redox enzymes.

Iron deficiency is generally caused by dietary iron deficiency compared to recommended needs. Certain medical conditions can lead to increased iron requirements. The amount of iron lost from the body is related to physiological conditions, for example, menstruation is the period of greatest iron loss for women of childbearing age. Women during pregnancy have an increased iron requirement, especially in the second half of pregnancy. In children, increased physiological requirements for development (in the fetus, postpartum and puberty) are an important factor affecting iron status.

The increased iron requirement can be met by a diet rich in iron with high biological value. However, in some developing countries, access to animal-source foods with high amounts of biologically valuable iron is very low and daily diets mainly consist of plant-based foods, so the risk of high iron deficiency.

Parasitic infections, especially hookworm infections and malaria, have the most significant impact on public health. In addition, Helicobacter pylori (H. Pylori) infection has recently been reported to have a high prevalence in developing countries, leading to iron deficiency but the mechanism and cause are still unknown. It is hypothesized that H. pylori infection reduces acid secretion, leading to decreased intestinal iron absorption. Other diseases such as ulcers and intestinal bleeding can also cause iron-deficiency anemia but are usually not a problem of public health significance.

It is very rare to have an excess of iron due to food consumption thanks to the body's own metabolism-regulating mechanism. However, iron accumulation may occur in patients requiring frequent blood transfusions in hemolytic anemia.

Side effects of consuming too much iron can include:

- Acute poisoning: with vomiting and diarrhea, followed by cardiovascular, central nervous system, renal, hepatic and hematological symptoms.
- Digestive disorders due to high doses of iron supplements such as constipation, nausea, vomiting, diarrhea.

Secondary iron overload occurs when the body's iron stores are increased as a result of repeated blood transfusions or hematologic disorders or an increased rate of iron absorption.

Maximum iron consumption limit

Normal adults and adolescents have a maximum iron intake limit of 45 mg/day (IOM, 2006) [46]. For children and young children, due to lack of data, the intake limit is calculated from the median value of the child's iron supplement.

Special considerations

There are some people who are very sensitive to excess iron such as those with hereditary iron absorption, chronic alcoholism, alcoholic cirrhosis and other liver diseases; iron intolerance; thalassemia, congenital atransferrinemia; and aceruloplasminemia. These individuals may not be protected by the maximum iron intake limit (UL).

Recommended intake

The iron requirement is applied according to the recommendations of FAO/WHO 2004, SEA-RDAs 2005. The requirement is calculated based on two biological value levels of dietary iron, varying iron requirements in women with menstruation, correcting for Vietnamese people's recommended weight

Recommended iron requirement (mg/day)

Nhóm tuổi	Male		Female	
	RDA by biological value of iron of the ration		*RDA by biological value of iron of the ration*	
	Absorb 10% **	Absorb 15% ***	Absorb 10% **	Absorb 15% ***
0-5 month	0,93		0,93	
6-8 month	8,5	5,6	7,9	5,2
9-11 month	9,4	6,3	8,7	5,8
1-2 years	5,4	3,6	5,1	3,5
3-5 years	5,5	3,6	5,4	3,6
6-7 years	7,2	4,8	7,1	4,7
8-9 years	8,9	5,9	8,9	5,9
10-11 years	11,3	7,5	10,5	7,0
10-11 age (menstrual)	24,5	16,4		
12-14 years	15,3	10,2	14,0	9,3
12-14 age (menstrual)	32,6	21,8		
15-19 years	17,5	11,6	29,7	19,8
20-29 years	11,9	7,9	26,1	17,4
30-49 years	11,9	7,9	26,1	17,4
50 -69 years	11,9	7,9	10,0	6,7
> 50 age (menstrual)	26,1	17,4		
> 70 years	11,0	7,3	9,4	6,3
Pregnant women (during the whole process)	+15 ****	+10 ****		
Breastfeeding Women	Haven't had a period yet	13,3	8,9	
Menstruation is back	26,1	17,4		

Source:

FAO/WHO. Vitamin and mineral requirementsin human nutrition. A report of a joint FAO/WHO expert consultation. Bangkok: FAO/WHO; 2004, *International Life Science Institute (ILSI, 2005). South Asia Region. Recommended Dietary Allowances: Harmonization in South East Asia. Asia, Current Status and Issues.*

*** Type of diet with average biological value of iron (about 10% of iron absorbed): When the diet contains meat or fish from 30g - 90g/day or vitamin C from 25 mg - 75 mg/day.*

**** Type of diet with high biological value of iron (about 15% of iron is absorbed): When the diet has meat or fish > 90g/day or vitamin C > 75 mg/day.*

***** Iron supplementation is recommended for all pregnant women throughout pregnancy. Pregnant women with anemia need to be treated according to current regimens.*

<u>Factors affecting iron requirement</u>

Individuals prone to iron deficiency: People with reduced gastric acidity, for example those who consume excessive amounts of antacids, alkaline drugs or have medical conditions such as gastric acid deficiency or partial gastrectomy. , can impair iron absorption and put you at high risk of iron deficiency.

Cow's milk is a poor source of iron with low biological value, so it is not recommended for use in children under 1 year of age. Improper early consumption of cow's milk is associated with a higher risk of iron-deficiency anemia.

Menstrual age: The recommended iron requirement for girls increases at age 14 to compensate for menstrual loss. For girls who reach this age but have not yet menstruated, the recommended requirement is 9.3 mg/day if the dietary biological value is 15%, and for those who have menstruating, the recommended intake is 21, 8mg/day if the biological value of the diet is 15%.

Adolescent and pre-adolescent growth spurts: Growth rates during growth spurts can be 2 times the average rate for boys and 1.5 times more for girls. Dietary iron requirements increase for boys and girls during the growth spurt.

Use of oral contraceptives and hormone replacement therapy: The use of oral contraceptives reduces menstrual blood loss. As a result, women's nutritional needs - recommended for Vietnamese - 67 - using oral contraceptives may have low iron requirements. Hormone replacement therapy can cause some problems with uterine bleeding in women. In this situation, women using hormone replacement therapy may have a higher iron requirement than postmenopausal women not using the therapy.

Vegetarians: Because heme iron has a better biological value than non-heme iron. It is estimated that the biological value of iron from a vegetarian diet is moderate (about 10% absorption) rather than 18% from a mixed Western diet. Therefore, the need for iron is 1.8 times higher for vegetarians.

Intestinal Parasite Infection: This is a common problem in developing countries, intestinal parasite infections can cause significant blood loss, thus increasing the individual's iron requirements.

Blood donation: Donating blood 500ml once a year needs to replenish iron loss equivalent to about 0.6 mg/day for a year. People who regularly donate blood have a higher need for iron.

Regular physical activity: Research shows that iron status is often limited/marginal or inadequate in many individuals, especially in women who engage in physical activity. strong and frequent. Iron requirements of individuals can be 30-70% higher than those who do not regularly participate in active physical activity.