

# IronCatch™



## Part One Iron Overview

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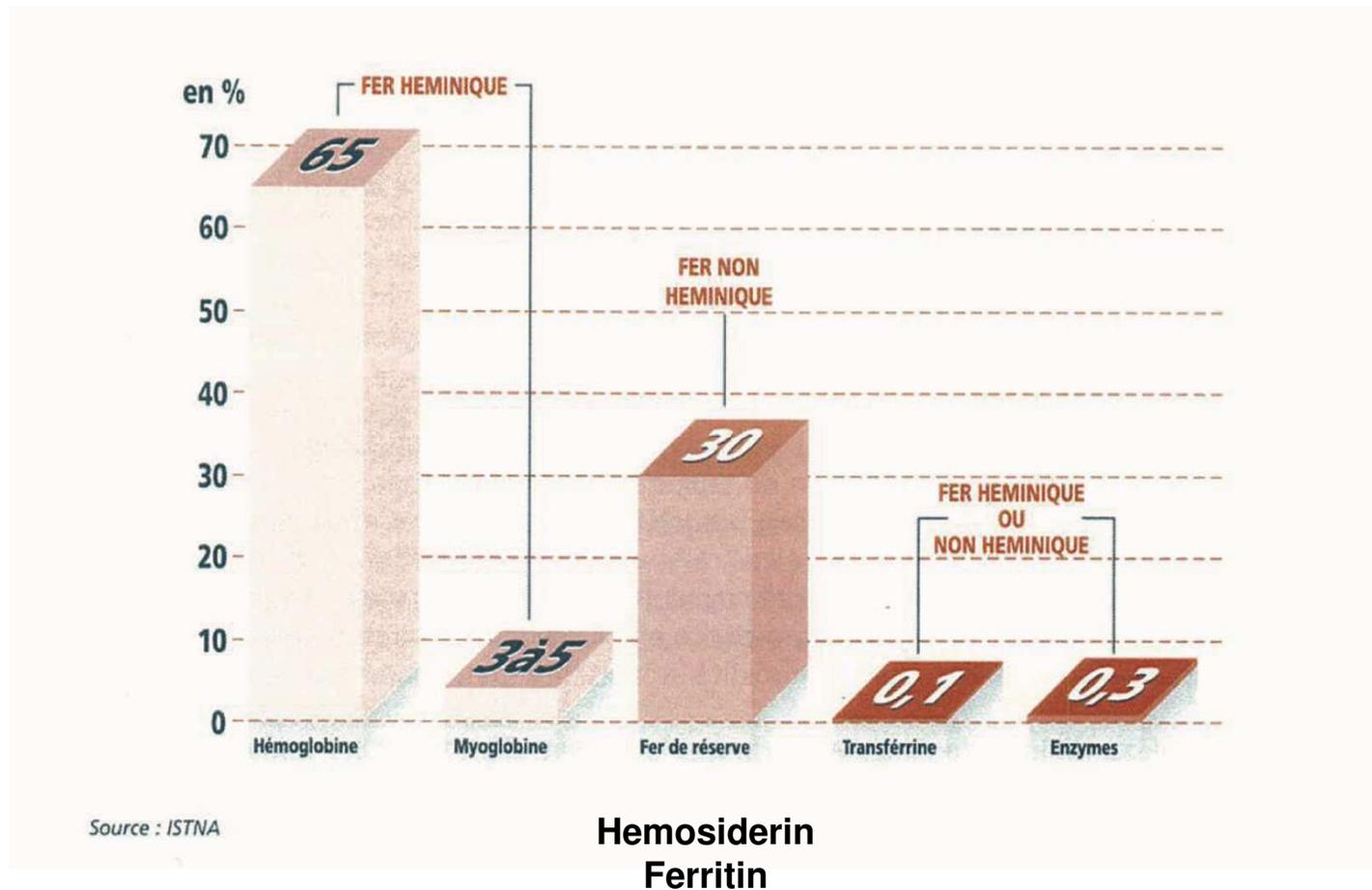
## **Iron: an indispensable partner for our body, playing a vital role within the organism**

- Iron is present in very low quantities within the body:
  - 4g in men
  - 2.5g in women
- or approximately 0.005% of the overall body weight

## Iron exists in the body in two forms:

- **Heme** iron contributes to the formation of hemoglobin, myoglobin and certain enzymes (cytochromes, catalases, lactoperoxidases...)
- **Non-heme iron** is present in equal quantities in numerous enzymes and corresponds to the forms of iron transportation (through transferrin) and iron reserves (ferritin and hemosiderin)

## Iron distribution within the body



**In men**, the quantity of iron eliminated daily amounts to approximately **1mg/die**

These iron losses occur through urine, bile, sweat and the intestines.



**In women**, from puberty until the menopause, additional losses occur due to the menstrual cycle.

Insufficient iron intake in relation to iron losses causes an iron imbalance. This is referred to as **iron deficiency**.

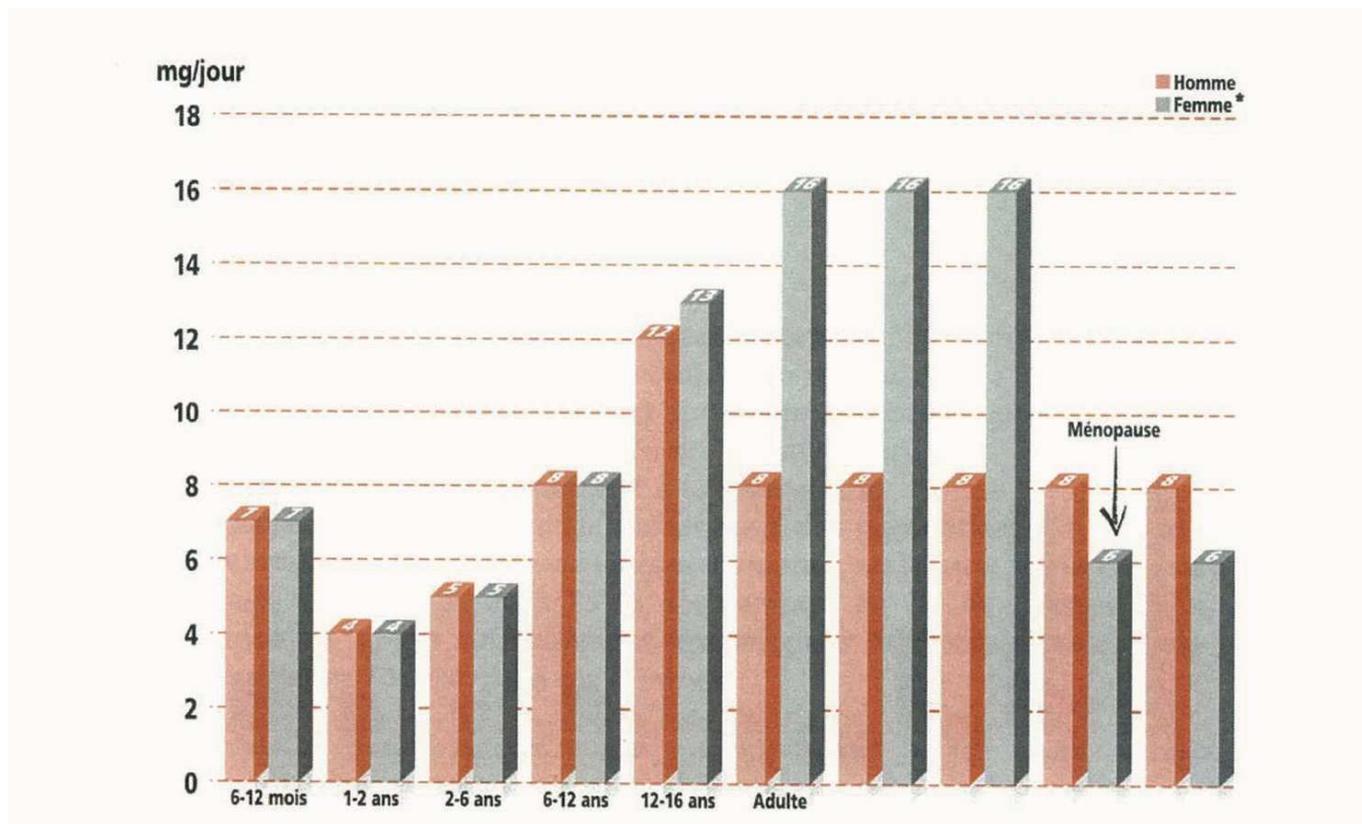


## The body's iron requirements:

- **These vary according to sex, age and different physiological circumstances. Iron requirements are especially high in:**
  - Growing children.
  - Pregnant women.
  - Women of fertile age (menstruating women).
  - People practising endurance sports.
  - Patients suffering from any disease where bleeding occurs

**RDA 14 mg**

## IRON REQUIREMENTS OF MEN AND WOMEN ACCORDING TO AGE AND SEX



Source: the recommended daily nutritional allowance for the French population – H. DUPIN, CNRS – CNERNA

\* Given the very high iron values required in pregnant women, it seemed impossible, despite the increase in iron absorption at the end of pregnancy, to propose recommended allowances to cover these requirements which would be compatible with an otherwise normal diet, in terms of energy intake.

In order to address these needs, it seemed necessary to provide, together with dietary advice, a systematic medicamentous supplement, in the correct doses.

## FOOD, THE SOURCE OF IRON

### **TWO FORMS/QUALITIES OF IRON TWO TYPES OF ABSORPTION**

- Only a small quantity of iron present in foods is truly absorbed.
- Absorption is directly related to the chemical form in which the iron is found. Foods contain two forms of iron:
  - non-heme iron with low bioavailability
  - heme iron with better bioavailability

## NON-HEME IRON

- **NON-HEME IRON** is contained in foods of plant origin, eggs and products derived from milk.
- has a low bioavailability (<5%).
- once consumed, gastric secretions free this type of iron from the complexes to which it is bound in foods
- having been liberated, this iron can be reduced, chelated or made insoluble, ie: **impossible to absorb**.
- has a limited absorption capacity by intestinal membranaceous receptors.

## OBSTACLES TO IRON ABSORPTION

- Absorption of non-heme iron is very variable and depends on the type of meal consumed: meat, poultry, fish and various organic acids stimulate the absorption of non-heme iron.
- Tannins, which are so common in plants, act as a very effective inhibitor to the absorption of non-heme iron (e.g. **tea, coffee, wine, egg yolk and bran**)
- **Intestinal absorption of non-heme iron diminishes progressively in proportion to the increase in the body's iron reserve, and viceversa.**

## HEME IRON

**HEME IRON** is found exclusively in the hemoglobin and myoglobin of animal products. This accounts for **40-50%** of the iron contained in meat and fish. Heme iron is especially bioavailable: **its absorption coefficient is approximately 20%.**

## THE RECOMMENDED DAILY ALLOWANCE OF IRON (RDA)

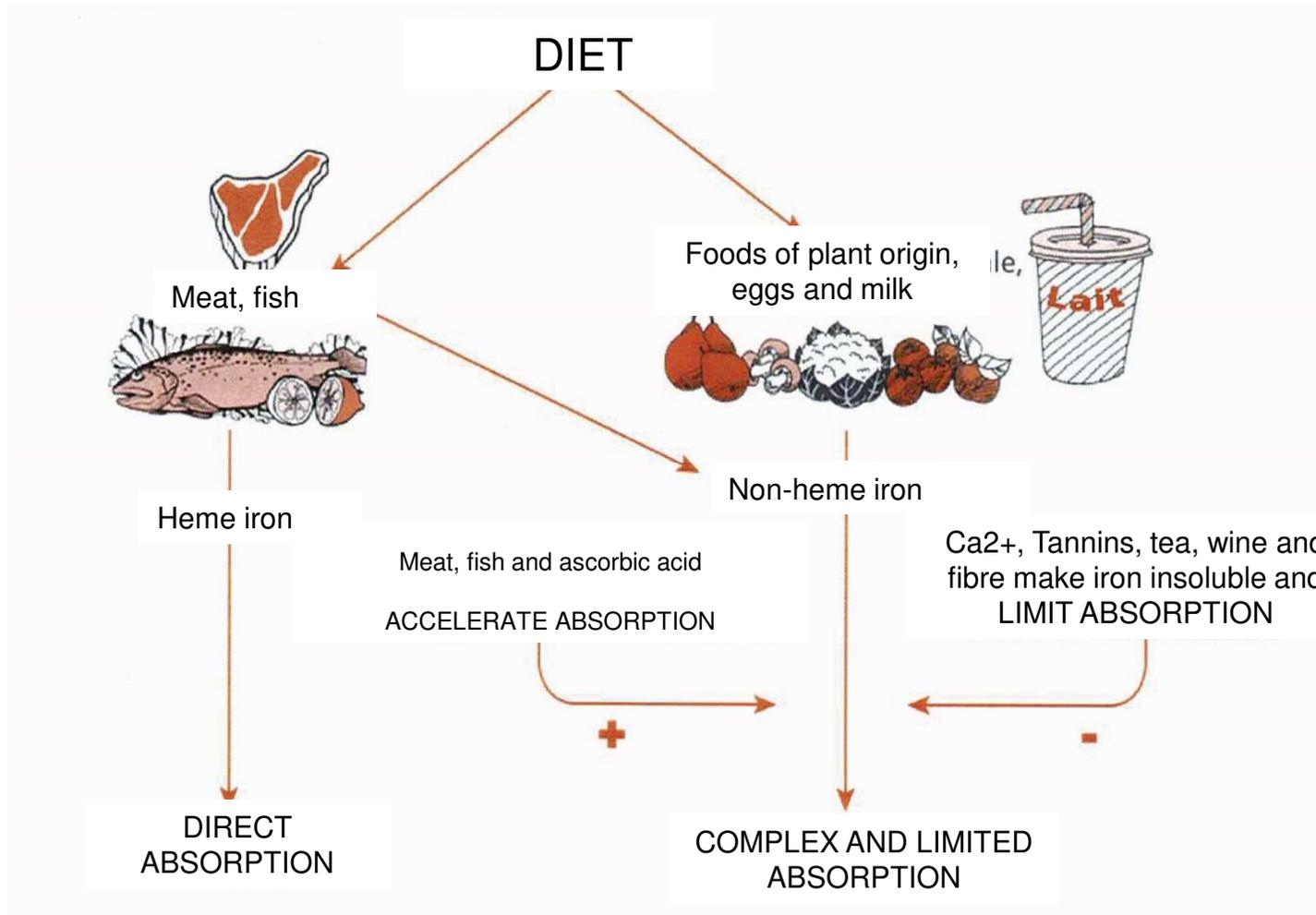
- Iron deficiency occurs when there is an iron imbalance in the body; i.e. In cases where the body's intake of iron is less than its requirements
- The recommended daily allowance of iron was established in 1992, taking the following into account:
  - The average absorption coefficient of iron from foods
  - The necessary level of iron reserves

## **IRON ALLOWANCE**

The recommended daily iron allowance: (mg per day)

<b>6-12 months</b>	<b>7</b>
<b>1-3 years</b>	<b>7</b>
<b>4-9 years</b>	<b>7</b>
<b>1-3 years</b>	<b>7</b>
<b>4-9 years</b>	<b>7</b>
<b>10-12 years</b>	<b>8</b>
<b>adolescents 13-19 years</b>	<b>12</b>
<b>adolescents 13-19 years</b>	<b>14</b>
<b>Adult males</b>	<b>9</b>
<b>Women with regular menstruation</b>	<b>16</b>
<b>Menopausal women</b>	<b>9</b>
<b>Breast-feeding women</b>	<b>10</b>
<b>Pregnant women</b>	<b>25-35</b>

# IRON ABSORPTION



- It should be noted that meat, fish and vitamin C facilitate the absorption of non-heme iron.
- In France, several studies carried out on pregnant women in good health have shown **iron deficiency levels of 60-75% in women at the end of pregnancy.**
- The iron deficiency is serious enough to cause anemia in 10-30% of these women.

## SIDEROPENIC ANEMIA

→ **SIDEREMIA <50**

→ **FERRITINEMIA <10**

### Due to:

- A. Reduced IRON absorption
- B. Excessive IRON loss
- C. In **chronic inflammatory conditions**, this type of anemia is also caused by **reduced erythropoiesis, secondary to proinflammatory cytokines and free radicals.**

## THE CONSEQUENCES OF IRON DEFICIENCY

- In the early stages, iron reserves are mobilized.
- Anemia is the most obvious clinical and biological sign of **serious iron deficiency**. It is identified by a reduction in the percentage of circulating hemoglobin and by the consequent clinical manifestations (paleness, asthenia, tiredness...).
- Prior to the anemic stage, there is the problem of possible negative effects due to **moderate iron deficiency**. Iron is involved in numerous biochemical processes: mitochondrial transportation of electrons, catecholamine metabolism and DNA synthesis.

## HEALTH IMPLICATIONS OF IRON DEFICIENCY

Iron deficiency anemia is an advanced stage of iron deficiency. Even the more moderate types of iron deficiency, known as “sub-deficiencies”, have significant clinical consequences:

- Reduction in physical strength
- Decline in intellectual performance
- Decrease in immune defences
- Poor fetal development
- Neurological symptoms (asthenia, irritability, loss of appetite, restless legs)

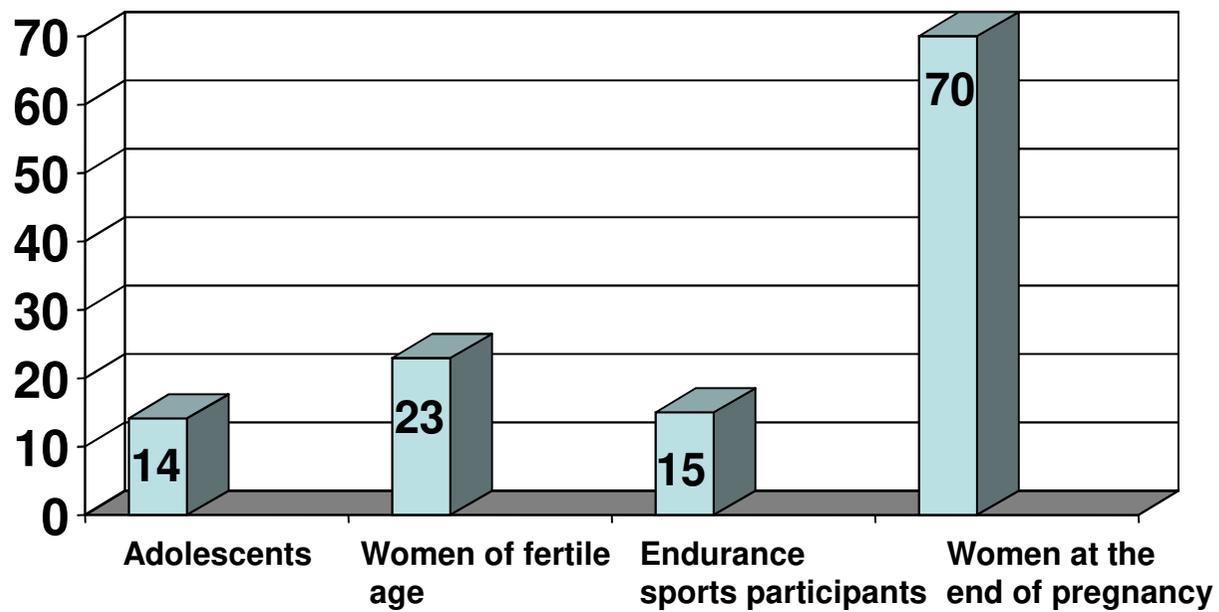
**Although the risk of overdose from oral iron supplements is low, it is still necessary for patients to be monitored by a doctor. In order to reduce the risk of excessive iron intake, it is advisable to adhere to the recommended daily allowance.**

**Clinical symptoms of overdose:**

Skin pigmentation, hepatosplenomegalia, symptoms of cardiac insufficiency, development of secondary diabetes, recrudescence of rheumatoid arthritis, **general oxidative state** and accelerated physical aging.

***ADVICE: when a family member suffers from hemochromatosis, it is necessary measure the ferritin level and the **transferrin saturation coefficient in iron (CSF)**.***

## IRON DEFICIENCY DISTRIBUTION IN THE POPULATION



**Approximately ¼ of all women of fertile age suffer from iron deficiency due to menstruation. The type of contraception used is a factor which produces significant variations.**

- **13.1%** of women who use oral contraception suffer from iron deficiency
- **23.2%** of women who do not use oral contraception suffer from iron deficiency
- **28.1%** of sterile women suffer from iron deficiency

**Around 15% of people who participate in endurance sports suffer from iron deficiency:**

- **25%** of athletes suffer from iron deficiency
- **8%** of marathon runners suffer from iron deficiency
- **12%** of cyclists suffer from iron deficiency

## **ABSORPTION LEVELS**

**HEME  
IRON**



**Absorbed at a level of 20%- 30%**

**NON HEME  
IRON**



**Absorbed at a level of 5%-10%**  
**(promoted by citric, lactic and Ascorbic acids)**

**Polyphenols and tannins reduce absorption  
(30% reduction)**

## **The location of IRON ABSORPTION**

Iron is absorbed **in the first part of the intestine** (duodenum and jejunum), due to the action of proteins:

**DMT1**

(absorption)

**HEPHAESTIN  
and IREG1**

(passage from mucous to blood)

**THE INTEGRITY OF THE MUCUS IS FUNDAMENTAL**

## IRON and FOODS

**IRON in foods:**

**6-7 mg/1000 Kcal**  
almost ubiquitous



**MEAT/FISH:**

**40% heme**  
**60% non-heme**



**OTHER FOODS:**

**100% non-heme**

**Generally, foods are never deficient in iron!**