Non-Communicable Diseases Watch

August 2024

Iron Status

Key Messages

※ Iron is an essential micronutrient for red blood cell formation and cellular functions. If iron intake and/or absorption is inadequate to meet physical requirements or to compensate for excess blood loss (such as due to menstruation among women of reproductive age), iron deficiency would occur. Progressive iron deficiency can eventually result in iron deficiency anaemia.

※ In Hong Kong, Population Health Survey 2020-22 revealed that the overall prevalence of iron deficiency among the local population aged 15–84 and women of reproductive age (aged 15–49) was about 5.7% and 17.5%, respectively. According to the World Health Organization's guideline to assess population's iron status, iron deficiency in Hong Kong is classified as a mild magnitude of public health problem.

※ Iron can be found in a variety of foods. In general, adequate iron intake can be achieved by a healthy balanced diet with iron-rich food. Women of reproductive age have a higher risk of iron loss during menstruation and hence a higher daily requirement for iron. They should pay particular attention to their diet to ensure adequate iron intake.

※ The Department of Health will continue to monitor the iron status among the local population, organise health promotional campaigns and work in close partnership with community partners to enhance public awareness about the importance of healthy eating, so as to maintain adequate iron intake and prevent iron deficiency.

Iron Status

Iron is an essential nutrient that the body needs for optimal physical growth, neurological development, cellular functioning and production of enzymes. More importantly, iron is a key component of haemoglobin that helps red blood cells carry oxygen from the lungs to the rest of the body. In muscles, iron is used to produce myoglobin (a protein found in the muscle cells) that stores oxygen and releases it when needed[1]. If iron intake and/or absorption is inadequate to meet physical require-ments (such as during pregnancy) or to compensate for physiological or pathological losses (such as chronic blood losses), body iron stores become depleted and iron deficiency occurs as a result[2, 3]. Progressive deficiency of iron will cause iron deficiency anaemia with subsequent symptoms including pallor, dizziness, fatigue, reduced exercise tolerance, poor attention and decreased work productivity[4, 5]. During pregnancy, iron deficiency anaemia is associated with an increased risk of adverse birth outcomes, including premature birth, low birth weight, maternal and neonatal mortality[4, 6]. In children, iron deficiency can impair cognitive function and learning[7]. Lack of iron could also weaken the immune system, leaving the body vulnerable to infections and diseases[4, 8]. An overseas study found that among older adults aged over 50 who did not have anaemia, those with iron deficiency would have a 58% increased risk of death compared with individuals without iron deficiency[9]. This article provides an overview of iron requirements for different groups of people and reports the iron status among the general population in Hong Kong with recommendations on iron nutrition.

Iron Requirements, Food Sources and Absorption

The recommended daily intake of iron varies depending on age, sex, physiological states, and other factors[10]. As shown in Table 1, women of reproductive age require more iron (18 milligrams (mg) per day) than men (12 mg per day) and postmenopausal women (10 mg per day) due to blood loss through menstruation. Pregnant women require additional iron (up to 29 mg per day during the third trimester) for meeting their own nutrition needs during pregnancy and making more red blood cells to

carry oxygen to the growing foetus. Breastfeeding mothers are susceptible to anaemia because of blood loss throughout childbirth, and thus they also require more iron (24 mg per day). While the recommended daily iron requirement for actively growing female adolescents aged 15−17 is 18 mg, the recommended iron requirement for their male counterparts is 16 mg per day[10].

Table 1: The recommended average amount in milligrams (mg) of iron requirements per day for different groups of people

Age / Stage	Male	Female
15−17 years old	16 mg	18 mg
18−49 years old	12 mg	18 mg
50 years old and older	12 mg	Pre-menopausal: 18 mg Post-menopausal: 10 mg
Pregnant women at the first trimester	-	18 mg
Pregnant women at the second trimester	-	25 mg
Pregnant women at the third trimester	-	29 mg
Lactating mothers	-	24 mg

Source: Dietary Reference Intakes for China (2023 version).

Iron can be found in a variety of foods, such as in the forms of haem iron found in animal products (such as meat, poultry, egg yolks, and seafood) and non-haem iron found in plant-based foods (such as cereals, pulses, legumes, nuts, seeds, fruits and vegetables). Compared to non-haem iron, haem iron is more readily absorbed by the body and less susceptible to modulation by other dietary components[3]. While most healthy people are able to get the necessary nutrients (including iron) by eating a balanced and varied diet, the amount of iron absorbed from a food or meal by individuals would largely be determined by body iron status (more iron will be absorbed if the body store is low; less iron is absorbed if body store is sufficient), the form of iron (as haem or non-haem) and potential interactions between iron and other nutrients[11].

For example, vitamin C enhances both haem and non-haem iron absorption and carotenes improve non-haem iron absorption. In turn, polyphenols found in tea, coffee, red wine, etc. inhibit the absorption of non-haem iron[3, 11].

Prevalence of Iron Deficiency and Related Anaemia

Globally, iron deficiency is the most prevalent nutritional deficiency and iron-deficiency anaemia is the most common type of anemia[12]. In 2019, iron deficiency affected around 14.4% of the population across the globe[13]. Of 1.92 billion anaemic cases in 2021, the Global Burden of Disease Study estimated that about two-thirds (66.2%) of them were due to iron deficiency with 825 million cases among women and 444 million cases among men[14].

In Hong Kong, the Department of Health (DH) conducted the Population Health Survey (PHS) 2020-22 which comprised of household survey and health examination. With regard to the health examination, among others, biochemical testing of blood for serum ferritin (a protein that stores iron inside the cells) and haemoglobin were included for the first time to assess the iron status of the local non-institutionalised population aged 15–84[15]. Based on recommendations of the World Health Organization (WHO), a serum ferritin cut-off value of below 15 micrograms per liter (µg/L) was used for defining iron deficiency among healthy adolescents and adults[16, 17]. Anaemia was defined as haemoglobin levels lower than 12 grams per decilitre (g/dL) in women and lower than 13 g/dL in men[18]. Iron deficiency anaemia was defined as individuals who were found to have both iron deficiency and anaemia.

Prevalence of Iron Deficiency

The PHS 2020-22 revealed that the overall prevalence of iron deficiency among persons aged 15–84 was 5.7%, whereas that for women of reproductive age (15–49 years) reached 17.5%. The prevalence of men and women of post-menopausal age (50–84 years) was 0.7% and 2.7%, respectively [15].

Prevalence of Iron Deficiency Anaemia

The PHS 2020-22 also revealed that the overall prevalence of iron deficiency anaemia among persons aged 15−84 was 3.5%, with remarkable difference between males (0.3%) and females (6.4%). Prevalence of iron deficiency anaemia was higher among women of reproductive age (10.6%) than women of post-menopausal age (2.1%)[15].

Magnitude of Public Health Problem

According to the WHO guidelines on use of ferritin concentrations to assess population's iron status[16], the iron deficiency prevalence of local population (5.7% for the general population or 17.5% for women of reproductive age) is classified as "mild magnitude of public health problem" (i.e. with population prevalence within 5.0%−19.9%). Besides, higher prevalence of iron deficiency and iron deficiency anaemia among local women of reproductive age are similar to that of relevant overseas studies in high income countries (such as the United States, Canada, the United Kingdom, Australia and Korea), and are believably due to their regular and heavy menstrual blood loss[15].

Joint Recommendations on Iron Intake for Members of the Public

To follow-up on the iron level of the local population, the DH has set up the Working Group on Prevention of Iron Deficiency (Working Group) with experts from the Centre for Food Safety of the Food and Environmental Hygiene Department, the Hospital Authority, the Hong Kong College of Community Medicine, the Hong Kong College of Family Physicians, the Hong Kong College of Obstetricians and Gynaecologists, the Hong Kong College of Pathologists, the Hong Kong College of Physicians, and the Hong Kong Red Cross Blood Transfusion Service. The Working Group has reviewed the key survey findings as well as the latest scientific evidence and opined that there is no evidence in supporting routine screening for iron deficiency or universal iron supplementation for asymptomatic individuals at average risk of iron deficiency.

The Working Group has also made the following joint recommendations on iron intake[19]:

● In general, adequate iron intake can be achieved by a healthy balanced diet with iron-rich food. Women of reproductive age have a higher risk of iron loss during menstruation and hence a higher daily requirement for iron. They should pay particular attention to their diet to ensure adequate iron intake.

(1) Consume iron-rich food

● Eat a moderate amount of meat, fish and seafood. Animal-based iron-rich food contains haem iron which can be absorbed easily;

● Eat more dark green vegetables and beans. Plant-based iron-rich food contains non-haem iron which is less readily absorbable and its absorption is affected by other foods and drinks in the diet;

● Iron-fortified cereals are also good sources of iron.

(2) Consume adequate fruit and vegetables

● Consume vitamin C-rich fruit and vegetables to enhance absorption of iron from plant sources.

(3) Reduce tea or coffee with meals

● Try to avoid drinking tea or coffee within 1 to 2 hours after meals as they can reduce iron adsorption. Plain water or water added with lemon is a better choice as a beverage for meals.

(4) Additional measures for those at higher risk of iron deficiency

● People at risk of iron deficiency (including women of reproductive age with heavy menstrual periods, pregnant women, persons on restrictive diets, persons with gastrointestinal disorders and/or having previous gastrointestinal surgery, frequent blood donors, etc.) may seek healthcare professionals' advice on management of their health conditions and individual needs for taking iron supple- ment. Of note, iron supplement with too much iron can be harmful.

For more information on iron rich food and heavy menstrual bleeding, members of the public can visit the thematic websites of the DH: "EatSmart Restaurant Star + Campaign", "Eat Smart to Prevent Iron Deficiency", "All about periods" and "Heavy Menstrual Bleeding and Iron Deficiency Anaemia".

The DH will continue to monitor the iron status among the local population, organise health promotional campaigns and work in close partnership with community partners to enhance public awareness about the importance of healthy eating, so as to maintain adequate iron intake and prevent iron deficiency.

References

1. Iron: Foods, Functions, and How Much Do You Need and More (11 January 2021). The European Food Information Council (EUFIC). Accessed at 15 July 2024: https://www.eufic.org.
2. Camaschella C. Iron deficiency. Blood 2019;133(1):30-39.
3. Pasricha SR, Tye-Din J, Muckenthaler MU, et al. Iron deficiency. Lancet 2021;397(10270):233-248.
4. Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health. Journal of Research in Medical Sciences 2014;19(2):164-174.
5. Lopez A, Cacoub P, Macdougall IC, et al. Iron deficiency anaemia. Lancet 2016;387(10021):907-916.
6. Georgieff MK. Iron deficiency in pregnancy. American Journal of Obstetrics and Gynecology 2020;223(4):516-524.
7. Pivina L, Semenova Y, Doşa MD, et al. Iron deficiency, cognitive functions, and neurobehavioral disorders in children. Journal of Molecular Neuroscience 2019;68(1):1-10.
8. Ni S, Yuan Y, Kuang Y, et al. Iron metabolism and immune regulation. Frontiers in Immunology 2022;13:816282.
9. Philip KEJ, Sadaka AS, Polkey MI, et al. The prevalence and associated mortality of non-anaemic iron deficiency in older adults: A 14 years observational cohort study. British Journal of Haematology 2020;189(3):566-572.
10. Chinese Nutrition Society. Dietary Reference Intakes for China (2023). Beijing: People's Medical Publishing House Co., Ltd.
11. Piskin E, Cianciosi D, Gulec S, et al. Iron absorption: Factors, limitations, and improvement methods. ACS Omega 2022;7(24):20441-20456.
12. Anaemia (1 May 2023). Geneva: World Health Organization. Accessed 15 July 2024: https://www.who.int/news-room/fact-sheets/detail/anaemia.
13. Global Burden of Disease Study 2019: Dietary iron deficiency--Level 3 cause. Accessed 15 July 2024: https://www.thelancet.com/pb-assets/Lancet/gbd/summaries/diseases/iron-deficiency.pdf.
14. Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990-2021: Findings from the Global Burden of Disease Study 2021. Lancet Haematology 2023; 10(9):e713-e734.
15. Thematic Report on Iron Status (Population Health Survey 2020-22). Hong Kong SAR: Department of Health.
16. WHO Guideline on Use of Ferritin Concentrations to Assess Iron Status in Individuals and Populations. Geneva: World Health Organization, 2020. Accessed 15 July 2024: https://www.who.int/publications/i/item/9789240000124.
17. Serum Transferrin Receptor Levels for the Assessment of Iron Status and Iron Deficiency in Populations. Geneva: World Health Organization, 2014. Accessed 15 July 2024: https://www.who.int/publications/i/item/WHO-NMH-NHD-EPG-14.6.
18. Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity. Geneva: World Health Organization, 2011. Accessed 15 July 2024: https://www.who.int/publications/i/item/WHO-NMH-NHD-MNM-11.1.
19. Joint Recommendations on Iron Intake for Members of Public Particularly for Women of Reproductive Age. Hong Kong SAR: Working Group on Prevention of Iron Deficiency.

Joint Recommendation on Iron Intake for Public Particularly for Women of Reproductive Age

Iron is an essential micronutrient for red blood cell formation and cellular functions. Iron deficiency is commonly caused by inadequate iron intake, or excess blood loss due to menstruation among women of reproductive age. Progressive iron deficiency can eventually result in iron deficiency anaemia which may present as fatigue and reduced exercise tolerance.

What is the local situation?

Population Health Survey 2020-22 provides useful insights into the population's iron status. Overall, the local prevalence of iron deficiency among the local population aged 15-84 and women of reproductive age (aged 15-49) was about 5.7% and 17.5% respectively. According to WHO's latest guideline in 2020, prevalence of iron deficiency ranging from 5.0-19.9% is classified as a mild magnitude of public health problem.

HOW TO MAINTAIN ADEQUATE IRON INTAKE

In general, adequate iron intake can be achieved by a healthy balanced diet with iron-rich food. Women of reproductive age have a higher risk of iron loss during menstruation and hence a higher daily requirement for iron. They should pay particular attention to their diet to ensure adequate iron intake.

Consume iron-rich food

Eat a moderate amount of meat, fish and seafood. Animal-based iron-rich food contains haem iron which can be absorbed easily.

Eat more dark green vegetables and beans. Plant-based iron-rich food contains non-haem iron which is less readily absorbable and its absorption is affected by other foods and drinks in the diet.

Iron-fortified cereals are also good sources of iron.

Consume adequate fruit and vegetables

Consume vitamin C-rich fruit and vegetables to enhance absorption of iron from plant sources.

Reduce tea or coffee with meals

Try to avoid drinking tea or coffee within 1 to 2 hours after meals as they can reduce iron absorption. Plain water or water added with lemon is a better choice as a beverage for meals.

Additional measures for those at higher risk of iron deficiency

People at risk of iron deficiency (including women of reproductive age with heavy menstrual periods, pregnant women, persons on restrictive diets, persons with gastrointestinal disorders and/ or having previous gastrointestinal surgery, frequent blood donors, etc.) may seek healthcare professionals' advice on management of their health conditions and their individual needs for taking iron supplement. Please note: iron supplement with too much iron can be harmful.

These above recommendations will be reviewed and revised in the light of new research findings.

For more information, please visit the Department of Health website: Thematic Report on Iron Status (Population Health Survey 2020-22): https://www.chp.gov.hk/en/features/37474.html

For access to the poster, please visit www.chp.gov.hk/files/pdf/ joint_recommendation_on_iron_intake_for_public_poster.pdf.