Arab Republic of Egypt

Egyptian Pediatric Clinical Practice Guidelines Committee (EPG)
Pediatric Hematology Group

Evidence-Based Clinical Practice Guideline for the

Prevention and Management of Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents

Adapted with permission from

WHO Guideline: Daily iron supplementation in adult women and adolescent girls. Geneva: World Health Organization; 2016.
WHO Guideline: Daily iron supplementation in infants and children. Geneva: World Health Organization; 2016.
Patient Blood Management Guidelines: Module 6 – Neonatal and Paediatrics, National Blood Authority (NBA) (2016)

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Disclaimer

Clinical Practice Guidelines (CPGs) are "systematically developed statements to assist health care professionals and patients in medical decision-making for specific clinical conditions" or they are "statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options". It is in no way a substitute for a medical professional's independent judgment. Most of the content herein is based on literature reviews. In areas of uncertainty, professional judgment was applied.

This CPG is a working document that reflects the state of the art in the field and is based upon the accessible best-updated published evidence. Because rapid changes in this area are expected, periodic revisions are inevitable. We encourage medical professionals to use this information in conjunction with, and not as a replacement for, their best clinical judgment. The presented recommendations may not be appropriate in all situations. Any decision by practitioners to apply these guidelines must be made considering local resources and individual patient circumstances.

The members of the Egyptian Pediatric Clinical Practice Guidelines Committee (EPG) Guideline Development/ Adaptation Groups (GDG/ GAG) and the external review groups receive no honoraria or expenses to attend the scientific review meetings, nor for the many hours spent reviewing the literature, appraising the guidelines, designing the implementation tools, and contributing to the writing of the report.

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Abbreviations

Adolopment	Adoption-Adaptation-Development
AGREE II	Appraisal of Guidelines for Research and Evaluation Instrument
CPG	Clinical Practice Guideline
DHS	Demographic and Health Survey
EDHS	Egypt Demographic and Health Survey
EMR	Eastern Mediterranean region
ENGC	Egyptian National Guidelines Committee
EPG	Egyptian Pediatrics Clinical Practice Guidelines Committee
EPG CPG	EPG Clinical Practice Guideline
ERG	External Review Group
GAG	Guideline Adaptation Group
GDG	Guideline Development Group
GPS	Good Practice Statement
GRADE	Grading of Recommendations Assessment, Development and Evaluation
Hb	Hemoglobin
ID	Iron deficiency
IDA	Iron deficiency anemia
OPC	Outpatient clinic
PICO	population, intervention, comparison, and outcomes
PIPOH	Patient population, intervention, professionals, outcomes, and healthcare context
RIGHT	A Reporting Tool for Practice Guidelines in Health Care
WHO	World health organization

Executive Summary

Introduction

For most parts of the world, Iron Deficiency (ID) guideline recommendations are somewhat heterogeneous largely because different patient populations are addressed. The purpose of developing the Egyptian guidelines is to identify strategies and comprehensive actions needed across the life cycle to eliminate anemia as a major public health problem among infants, young children and adolescents based on the available evidence.

Scope

This guideline focuses on prevention and management of Iron deficiency (ID) and Iron deficiency anemia (IDA) in infants, children and adolescents

Guideline development process and methods

After reviewing all the inclusion and exclusion criteria and quality appraisal results, the GDG/ GAG recommended using the following source original clinical practice guidelines (CPGs):

1. WHO Guideline: Daily iron supplementation in adult women and adolescent girls. Geneva: World Health Organization; 2016.
2. Guideline: Daily iron supplementation in infants and children. Geneva: World Health Organization; 2016.
3. Patient Blood Management Guidelines: Module 6 – Neonatal and Paediatrics, National Blood Authority (NBA) (2016)

We conducted Adolopment for these guidelines: (Adoption, Adaptation, and Development)

- Adoption for most of the guideline recommendations.
- Development of Good Practice Statements

Recommendations and Good Practice Statements (GPS)

This version of the CPG includes recommendations and good practice statements on the following four sub-sections:

A. ***Screening of*** **Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents**

B. ***Diagnosis of*** **Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents**

The guideline covers (Age group) Infants, children & adolescents less than 18 years

This guideline emphasis on

C. ***Treatment of*** **Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents**

D. ***Prevention of*** **Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents**

We can summarize the guidelines' recommendations for the Prevention and Management of Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents in the following:

- Routine dietary history and clinical screening for symptoms and signs of iron deficiency anemia in infants, children and adolescents is recommended by the primary health care professional/ pediatricians in primary health care setting/ OPC, yearly school visits (GPS).

- Laboratory screening of the general population for ID/IDA is not recommended. However, testing of infants, children and adolescents identified by clinical screening i.e. symptoms and signs is recommended (Very Low LOE, weak recommendation).
- The presence of clinical manifestations of IDA in the presence of microcytic hypochromic anemia and low ferritin. Anemia is diagnosed if hemoglobin level is below the cut-off level for age and sex. Microcytosis is diagnosed if mean corpuscular volume is below -2SD for age related reference range. Iron deficiency is considered if serum ferritin level is below 12 ug/L in the absence of infection/ inflammation or below 30 ug/L in all age groups in the presence of infection/ inflammation. Oral iron therapy in a dose: 3-6 mg/kg / day for all ages. Forms: syrup; tablets (each preparation contains different elemental iron dose) (not exceed maximum dose). Time: 1hour before or 2 hours after meals with Vitamin C at daytime To be monitored after one month by CBC and reticulocytic count, then at 3, 6 months. If no response after one month: revise dose, compliance, tolerability, type of formula and consider change of formula for another month. Duration: for 3 months after recovery of hemoglobin (Very Low LOE, weak recommendation).
- Daily iron supplementation of 10-12.5mg elemental iron for three consecutive months is recommended as a public health intervention in infants and young children aged 6-23 months, living in settings where anemia is highly prevalent (Moderate LOE, strong recommendation).
- Daily iron supplementation of 30 mg elemental iron for three consecutive months is recommended as a public health intervention in preschool children aged 24 to 59 months, living in settings where anemia is highly prevalent (Very Low LOE, strong recommendation).
- Daily iron supplementation of 30-60 mg elemental iron for three consecutive months is recommended as a public health intervention in school aged children aged 5-12 years, living in settings where anemia is highly prevalent (High Loe, strong recommendation).
- Start complementary feeding with iron rich food. Avoid cow milk, goat milk, soy to infants under12 months of age. From 12 months, cow milk should not exceed 500 ml per day. For non- breast fed infants, iron fortified formula can play role in prevention and treatment of IDA (GPS).
- Tips for Oral iron intake (GPS)
  - Lower and intermittent dose may be as effective and better tolerated
  - To avoid gastric upset can be taken at night and increasing dose gradually
  - Teeth staining can be avoided by brushing teeth and taking with water.
- If oral iron is ineffective or is not tolerated consider other causes of anemia and refer to Hematologist (avoid parenteral iron therapy) (GPS).
- Packed RBCs should be considered only after Hematologist opinion (GPS).
- Nutritional support with iron rich formulas, solid food and oral iron support 1-2mg/kg/day elemental iron should be used to treat asymptomatic iron deficiency anemia in infants (GPS).
- Referral to hematologist should be considered in cases of severe anemia, history of recurrent bleeding or with failure of increase in the hemoglobin concentration after proper iron dose and proper way of administration (GPS).

Introduction

Infants and young children are vulnerable to anemia especially iron deficiency anemia (IDA), which represents a public health problem with defined impacts on the health of communities.[1] Published evidence suggests that early infant feeding practices play a major role in the prevalence of iron deficiency (ID) and IDA.[2,3] Anemia early in life, with or without iron depletion, is known to seriously affect children's general health and immunity, retarding their growth and development by causing multiple disorders and abnormalities in different body systems.[3–5]

Anemia may be defined as haemoglobin (Hb) concentration 2 SD below the mean Hb concentration for a normal population of the same gender and age range. ID, the most common cause of anemia, is characterized by a depletion of iron in various body compartments and/or tissues. IDA evolves when ID is severe enough to significantly affect erythropoiesis.[3- 6] IDA is a preventable and treatable condition; therefore, early diagnosis represents the cornerstone in protection from its adverse consequences and combating its contributing factors.

Globally, ID is the most common and widespread nutritional disorder affecting all age groups. Children in developing countries are particularly affected where prevalence as high as 50% has been reported among infants aged 12 months. IDA is a leading cause of mortality and morbidity among infants worldwide and some of its manifestations are possibly irreversible.[7–14] In a systematic review done in 2012 to evaluate micronutrient deficiencies and food fortification in the Middle East, ID represented one of the three most common micronutrient deficiencies in the region in addition to iodine and vitamin A.[15] According to WHO, in 2013 63% of children under 5 years in the Eastern Mediterranean region (EMR) had IDA and in some studies, anemia among preschool children showed similarly high rates.[16]

According to a UNICEF report, more than two billion individuals have anemia worldwide and most of them have IDA, especially in underdeveloped and developing countries, where 40-50% of children are iron deficient compared with 6-20% in developed countries .[17]
In Egypt, High levels of anemia remain a critical issue of micronutrient deficiencies affecting children below five years, women of reproductive age and adolescents. Egypt Demographic and health survey (DHS) 2014 showed that 27.2 percent of children under-5 in Egypt have some degree of anemia, with 9.5 percent being moderately anemic and the remaining 17.8 percent mildly anemic. While, girls age 5-19 years were somewhat more likely than boys in the age group to be anemic (21 percent and 18 percent, respectively). Most anemic children age 5-19 years were only mildly anemic. Among girls, the proportion anemic was highest in the 12-14-year age group (25 %) and lowest among children in the 10-11 age group (14 %). Among boys, the anemia level was highest in the 15-19 age group (22 %) and, similar to the pattern for girls, lowest in the 10-11 age group (10 %).[18]

The prevalence of anemia among children less than 5 years (% of children under 5) in Egypt was 31.70 in 2016. Its highest value over the past 26 years was 42.50 % in 1990, while its lowest value was 31.70 % in 2016.[19]

Iron transfer from mother to fetus occurs mainly during the third trimester of pregnancy and is stored mainly in the liver and bone marrow. Thus, the amount of iron present at birth depends on the gestational age and weight of the baby.[17] Full-term infants usually have sufficient iron stores until 4–6 months of age. During the infantile growth spurt, human milk (which contains 0.2–0.3 mg/L of iron) may not

provide enough iron to meet high demands for rapid growth and erythropoiesis. Therefore, existing iron stores are mobilized to meet the iron requirements of the infant mostly around the age of 4–6 months. This may result in stores being generally depleted by the age of 6 months, yet from 4 months to 12 months after birth, the infant's blood volume doubles, causing a 'physiologically dilution effect' for red blood cells and Hb. Thus, at this age, dietary sources of iron become critical to keep up with the rapid rate of growth and red blood cell synthesis.[20–22]

Studies have shown that increased nutritional requirements during the growth spurt may often lead to a negative nutrient balance.[2] In general, prolonged exclusive breast feeding (more than 6 months) predisposes to decreased dietary iron intake and may lead to iron depletion.[20- 26]

The diagnosis of iron deficiency is made primarily based on laboratory measurements; however, the tests used commonly have limitations because of their poor sensitivity or specificity, or because they are modified by conditions other than iron deficiency (such as inflammation). Therefore, combining several iron status indicators provides the best assessment of iron status. [2] A complete blood count may indicate low Hb levels. Serum ferritin reflects total body iron stores. The most useful single laboratory value for the diagnosis of iron deficiency may be plasma ferritin.

Infant feeding counseling offered to mothers and other caregivers on how to gradually increase consistency and quantity of foods also assists in prevention of micronutrient deficiency.[26, 27] Preterm babies, as well as, those born small for gestational age, are particularly vulnerable to ID in their first months of life.[2 ,28 ,29] Infants delivered by caesarean section are more likely to get ID, as their delivery is associated with reduced placental transfusion and poor iron-related hematological indices in both cord and peripheral blood.[30]

The treatment of IDA depends mainly on oral iron supplements, which are desirable as a first-line therapy. The most commonly used preparations are ferrous fumarate, ferrous sulfate, and ferrous gluconate and the main side effects are gastrointestinal disturbances. Treatment should be continued for at least 3 months at a dose of 3-6 mg/kg/day, best taken between meals on an empty stomach .[2,7,31]

Prevention and control strategies against IDA are mainly dependent on the timing of diagnosis and start of treatment.[7] The WHO 'Global Strategy for Infant and Young Child Feeding' was developed as guidance to the prevention of micronutrient deficiencies including ID and IDA.[26] Many studies indicate that incidence of IDA has significantly decreased over time due to promotion of breast feeding, improvement of overall nutritional status and use of iron-fortified baby foods.[2]

A recent systematic review of 29 guidelines was published in 2015.[32] These guidelines were developed by professional associations throughout the world including the United States (n = 8), Europe (n = 6), Britain (n = 4), Canada (n = 3), other international organizations (n = 2), France (n = 2), Poland (n = 1), Australia (n = 1), Mexico (n = 1), and Japan (n = 1). Findings from this guideline summary reveal that, for the most part, Iron Deficiency (ID) guideline recommendations are somewhat heterogeneous largely because different patient populations were addressed. The purpose of developing the Egyptian guidelines was to identify strategies and comprehensive actions needed across the life cycle to eliminate anemia as a major public health problem among infants, young children and adolescents based on the available evidence.

Purpose and Scope

These guidelines have been developed to standardize the delivery of services and to implement the guidance on the prevention, diagnosis and management of Iron deficiency (ID) and Iron deficiency anemia (IDA) in infants, children and adolescents.

It provides guidance to primary health care providers, pediatricians and specially trained nurses.

The guidelines aimed to assist the practitioners (Primary and secondary Health care practitioners working in governmental, non-governmental and private sectors) to apply the best available research evidence to clinical decisions about the prevention and management of iron deficiency and iron deficiency anemia in infants, children and adolescents.

This version of the guideline includes recommendations and good practice statements for prevention, diagnosis and management of Iron deficiency (ID) and Iron deficiency anemia (IDA) in infants, children and adolescents.

Methods

Methods of search:

A comprehensive search for guidelines was undertaken to identify the most relevant guidelines to consider for adaptation. Keywords used for search are: Anemia, Iron-deficiency, Iron-deficiency anemia, Pediatrics.

Inclusion / exclusion criteria followed in the search and retrieval of guidelines to be adapted:

• Selecting only evidence-based guidelines (guideline must include a report on methodology of development including the systematic literature searches and explicit links between individual recommendations and their supporting evidence)
• Selecting national and/or international guidelines
• Specific range of dates for publication (using Guidelines published or updated 2013 and later or the last 5 years)
• Selecting peer-reviewed publications only
• Selecting guidelines written in English language
• Excluding guidelines written by a single author

The following three categories of databases and websites were searched:

1. *CPG databases and libraries (e.g., GIN, ECRI, SIGN, DynaMed, BIGG-REC PAHO)*
2. *Bibliographic databases (e.g., PubMed, Google Scholar)*
3. *Specialized professional societies (related to the pediatric subspecialty)*

All retrieved Guidelines were screened and appraised using AGREE II instrument (www.agreetrust.org) by at least two members. The panel decided a cut-off point or rank the guidelines (any guideline scoring above 60% on the rigor dimension was retained)

After reviewing all the previous criteria the GDG/ GAG recommended using 3 guidelines:

1. **WHO Guideline: Daily iron supplementation in adult women and adolescent girls. Geneva: World Health Organization; 2016.**
2. **Guideline: Daily iron supplementation in infants and children. Geneva: World Health Organization; 2016.**
3. **Patient Blood Management Guidelines: Module 6 – Neonatal and Paediatrics, National Blood Authority (NBA) (2016)**

We did Adolopment for these guidelines: (Adoption, Adaptation, and Development)

- Adoption for most of the guideline recommendations.
- Development of Good Practice Statement

Contributors to the guideline development process:

Guideline Development Group (GDG)/ Guideline Adaptation Group (GAG):

The GDG/ GAG included two subgroups; the clinicians/ healthcare providers subgroup and the guideline methodologists' subgroup.

Clinicians Subgroups

The clinicians' subgroup or clinical panel for this guideline included experts with a range of knowledge, technical skills and diverse perspectives in the field of Hematology and Nutrition. The main functions of the clinical panel were adolopment of selected WHO and NBA Guidelines, determining the scope of the guideline and guideline, reviewing the evidence, and formulating evidence-informed recommendations in case of changing strength of recommendations.

Guideline Methodologists Subgroup

There were 7 guideline methodologists with expertise in guidelines development, adaptation, GRADE and translation of evidence into recommendations. Methodologists provided orientation and overview of evidence-informed guideline development processes using the GRADE approach, guideline adaptation using the Adapted ADAPTE, provided AGREE II assessment of the source guidelines in collaboration with the clinicians subgroup, generation of the EtD frameworks whenever applicable.

External Review Group:

The External Review Group for this guideline comprises 3 clinical national experts who have interest and expertise in as well as an eminent international reviewer.

They were identified by Egyptian Pediatric Clinical Practice Guidelines Committee (EPG) as people who can provide valuable insights during the guideline development process.

The External Review Group was asked to comment on (peer review) the final guideline to identify any criticism on the content and to comment on clarity and applicability as well as issues relating to implementation, dissemination, ethics, regulations, or monitoring, but not to change the recommendations formulated by the GDG/ GAG. The members of the External Review Group were required to submit declarations of interest before the peer review process.

Guideline Development/ Adaptation Group meetings:

GDG/ GAG meetings were organized virtually (weekly/bimonthly). Due to the extensive scope of

the guideline, EPG was responsible for overseeing the adolopment process. the timetable and objectives of each meeting. GDG/ GAG meetings were also attended by members of the methodologists. Working rules for each contributor type were outlined by the chair at the start of each meeting, covering aspects such as vocal rights, voting, and evidence to decision and recommendation formulating processes.

Declarations of interests:

Prospective members of the GDG/ GAG were asked to fill in and sign the standard WHO declaration of interest and confidentiality undertaking forms. All guideline members and methodologists were also asked to fill in and sign the standard WHO declaration-of-interests. Members of the external review group will be asked to fill in and sign the standard WHO declaration-of-interests form before the peer review process.

Evidence for the guideline:

We used the GRADE system (Grading of Recommendations, Assessment, Development and Evaluation) for assigning the quality of evidence and strength of recommendations that includes the following definitions.

Description of the interpretation of the GRADE four levels of certainty of evidence:

Table 1. Classification of the Quality of Evidence

High	We are very confident that the true effect lies close to that of the estimate of the effect.
Moderate	We are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very Low	We have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of the effect.

Table 2. Classification of the Strengths of Recommendations

Strong	The desirable effects of an intervention clearly outweigh the undesirable effects (or vice versa), so most patients should receive the recommended course of action.
Conditional	There is uncertainty about the trade-offs. The clinician and patient need to discuss the patient's values and preferences, and the decision should be individualized.

Developing good practice statements:
The GDG/ GAG also developed good practice statements for this guideline, which are actionable messages relevant to the guideline questions. The justification for each good practice statement was carefully considered by the GDG/ GAG with an emphasis that they are clearly needed. Good practice statements were developed, guided by the following GRADE criteria:
1- Message is really necessary with regard to actual healthcare practice
2- Have large net positive consequence (relevant outcomes and downstream consequences) (GRADE EtD domains)
3- Collecting and summarizing the evidence is a poor use of time and resources
4- Include a well-documented, clear rationale connecting indirect evidence
5- Are clear and actionable statements.

The GDG/ GAG collectively drafted and finalized good practice statements with relevant justifications and remarks to help with their interpretation, with close support and input from the consultant and guideline methodologists.

We have used the Reporting Items for Practice Guidelines in Healthcare (RIGHT) extension for adapted guidelines (RIGHT-Ad@pt Tool) as a reporting checklist for this guideline adaptation process as recommended by the EQUATOR network.

Recommendations

Table 3. Recommendations					
A. Screening					
N	**Health questions**	**Source Guideline**	**Recommendations**	**Quality of evidence**	**Strength of Recommendation**
A 1	Does clinical screening for symptoms and signs of iron deficiency anemia in infants and children done by the primary health care professional/ pediatrician in primary health care setting/ outpatient clinic (OPC),improve the early detection of IDA and the neurodevelopmental outcome?		**Clinical screening for symptoms and signs of iron deficiency anemia in infants and children done by the primary health care professional/ pediatricians in primary health care setting/ OPC improves the early detection of IDA and the neurodevelopmental outcome.**	**Very Low**	**Good practice statement**
A 2	Does clinical screening for symptoms and signs of iron deficiency anemia in adolescent females at yearly school visit, done by the primary health care professional/ pediatrician in primary health care		**Clinical screening for symptoms and signs of iron deficiency anemia in adolescent females at yearly school visit, done by the primary health care professional/ pediatrician in primary health care setting/ OPC, improves the early detection of IDA.**	**Very Low**	**Good practice statement**

	setting/ OPC, improve the early detection of IDA?				
A 3	Does routine dietary history checklist for iron containing food in infants, children and adolescents, done by the primary health care professional/ pediatrician in primary health care setting/ OPC, help identify dietetic problems, improve the early detection of ID/IDA and neurodevelopmental outcome?		**Routine dietary history checklist for iron containing food in infants, children and adolescents, without non -iron related comorbidities, done by the primary health care professional/ pediatrician in primary health care setting/ OPC, helps identify dietetic problems, improve the early detection of ID/IDA and neurodevelopmental outcome.**	**Very Low**	**Good practice statement**
A 4	Is there a non-invasive, simple, safe, precise screening test for ID/IDA in infants, children and adolescents?		- **There is no one test considered gold standard for diagnosing iron deficiency or IDA, so official recommendations vary.** - **There is no sufficient evidence to recommend specific screen tests for IDA.** - **No studies evaluating the benefits or harms of screening programs for asymptomatic children**	**Very Low**	**Good practice statement**
A 5	Does routine basic laboratory		**Laboratory screening of the**	**Very Low**	**Good practice statement**

	screening for ID/IDA in infants, children and adolescents, in primary health care setting or OPC improve the early detection of ID/IDA and the neurodevelopmental outcome?		**general population for ID/IDA is not recommended** ▪ **Laboratory testing of infants, children and adolescents at high risk (identified by clinical screening i.e. symptoms and signs) is recommended**		

Table 3. Recommendations					
B. Diagnosis					
N	**Health questions**	**Source Guideline**	**Recommendations**	**Quality of evidence**	**Strength of Recommendation**
B1	What are the laboratory tests with the cut-off levels for diagnosis of IDA in infants, children and adolescents, in primary health care setting or OPC?	**WHO 2016**	**- Anemia is diagnosed if hemoglobin level is below the cut-off level for age and sex.** **- Microcytosis is diagnosed if mean corpuscular volume is below -2SD for age related reference range.** **- Iron deficiency is considered if serum ferritin level is below 12 ug/L in all age groups in the absence of infection/ inflammation.** **- Iron deficiency is considered if serum ferritin level is below 30 ug/L in all age groups in the presence of infection/ inflammation**	**Very Low**	**Weak (Conditional)**

Table 4. Recommendations		
C. Treatment and monitoring response		

N	Health questions	Source Guideline	Recommendations	Quality of evidence	Strength of Recommendation
C1	What is the best treatment, dose and duration for treatment of ID and IDA in infants, school children and adolescents done in primary health care setting or general pediatric department to ensure successful treatment of ID and IDA?	**NBA 2016**	**Oral iron therapy: Dose: 3-6 mg/kg / day for all ages Forms: syrup; tablets (each preparation contains different elemental iron dose) (not exceed maximum dose)** **Time:** 1hour before or 2 hours after meals with Vitamin C at daytime	**Low**	**Good practice statement**
C2	What is the most cost effective plan to monitor response to treatment of infants, school children and adolescents with identified ID and IDA, in primary health care setting or general pediatric department, to ensure successful treatment of ID and IDA?	**NBA 2016**	**Monitoring:** after one month by CBC and reticulocytic count, then at 3, 6 months. **If no response after one month:** revise dose, compliance, tolerability, type of formula and consider change of formula for another month **Duration:** for 3 months after recovery of hemoglobin **Tips for Oral iron intake** - Lower and intermittent dose may be as effective and better tolerated - To avoid gastric upset can be taken at night and increasing dose gradually - Teeth staining can be avoided by brushing teeth and taking with water	**Low**	**Good practice statement**
C3	Does history taking about symptoms suggestive of	**NBA 2016**	**If oral iron is ineffective or is not tolerated consider**	**Low**	**Good practice statement**

	possible gastrointestinal malabsorption, losses or inflammatory conditions in patients identified with IDA with no obvious dietetic problem help in diagnosing underlying undiagnosed etiology compared to simple dietetic history taking?		**other causes of anemia and refer to Hematologist (avoid parenteral iron therapy)** **Packed RBCs should be considered after Hematologist opinion**		
C4	When to consider referral to hematologist/ gastroenterologist / gynecologist, in infants, school children and adolescents with ID and IDA, in primary health care setting or general pediatric department?		**Referral to hematologist should be considered in cases of severe anemia, history of recurrent bleeding or with failure of increase in the hemoglobin concentration after proper iron dose and proper way of administration**	**Low**	**Good practice statement**

Table 4. Recommendations					
D. Prevention by supplementation and diet					
N	**Health questions**	**Source Guideline**	**Recommendations**	**Quality of evidence**	**Strength of Recommendation**
D1	Does routine iron supplementation help in preventing development of ID and IDA in infants, children and adolescent females in primary health	**WHO 2016**	**Daily iron supplementation of 10-12.5mg elemental iron for three consecutive months is recommended as a public health intervention in infants and young children aged 6-23 months, living in settings**	**Moderate**	**Strong**

	care setting or general pediatric department?		**where anemia is highly prevalent.**		
		WHO 2016	**Daily iron supplementation of 30 mg elemental iron for three consecutive months is recommended as a public health intervention in preschool children aged 24 to 59 months, living in settings where anemia is highly prevalent.**	**Very Low**	**Strong**
		WHO 2016	**Daily iron supplementation of 30-60 mg elemental iron for three consecutive months is recommended as a public health intervention in school aged children aged 5-12 years, living in settings where anemia is highly prevalent.**	**High**	**Strong**
D2	Does routine dietary modification with high iron containing food help in preventing development of ID and IDA in infants, children and adolescent females in primary health care setting or general pediatric department?	**NBA 2016**	**Dietary prevention** • Start complementary feeding with iron rich food • Avoid cow milk, goat milk, soy to infants under12 months of age • From 12 months, cow milk should not exceed 500 ml per day • For non- breast fed infants, iron fortified formula can play role in prevention and	**Low**	**Good practice statement**

			treatment of IDA		

Evidence to recommendations: Considerations

The GDG/ GAG was guided by the results of the AGREE II appraisals of the eligible CPGs and thoroughly reviewed the recommendations of the original source WHO CPGs in consideration of local contextual factors related to the national Egyptian health system like burden of the disease, equity, acceptability, feasibility, and other relevant factors. Also, GDG/ GAG develops group of good practice statements to improve acceptability and feasibility.

Implementation Tools and Considerations

To improve healthcare provision, quality, safety, and patient outcome, evidence-based recommendations must not only be developed, but also disseminated and implemented at national and local levels and integrated into clinical practice.

Dissemination involves educating related healthcare providers to improve their awareness, knowledge and understanding of the guideline's recommendations. It is one part of implementation, which involved translation of evidence-based guidelines into real life practice with improvement of health outcomes for the patients.

Implementation requires an evidence-based strategy involving professional groups and stakeholders and should consider the local cultural and socioeconomic conditions. Cost-effectiveness of implementation programs should be assessed.

Specific steps need to be followed before clinical practice recommendations can be integrated into local clinical practice, particularly in low resource settings.

Steps of implementing …… diagnosis, treatment, and prevention strategies into the Egyptian health system:

1. Develop a multidisciplinary working group.
2. Assess the status of nutritional care delivery, care gaps and current needs.
3. Select the material to be implemented, agree on the main goals, identify the key recommendations for diagnosis, treatment and prevention and adapt them to the local context or environment.
4. Identify barriers to, and facilitators of implementation.
5. Select an implementation framework and its component strategies.
6. Develop a step-by-step implementation plan:
    - Select the target populations and evaluate the outcome.
    - Identify the local resources to support the implementation.
    - Set timelines.
    - Distribute the tasks to the members.
    - Evaluate the outcomes.
7. Continuously review the progress and results to determine if the strategy requires modification.

Guideline implementation strategies will focus on the following: -

1. **For Practitioners**
    - Educational meetings: conferences, lectures, workshops, grand rounds, seminars, and symposia.

- Educational materials: printed or electronic information (software).
- Web-based education: computer-based educational activities.
- A trained person meets with providers in their practice setting to provide information with the intention of changing the provider's practice. The information may include feedback on the performance of the provider(s).
- Reminders: the provision of information verbally, on papers or on a computer screen to prompt a health professional to recall information or to perform or avoid a particular action related to patient care.
- Optimize professional-patient interactions, through mass media campaigns, reminders, and education materials.
- Practice tools: tools designed to facilitate behavioral/practice changes, e.g., flow charts.

2. **For Patients and care givers**
    - Patient education materials (Arabic booklet): Printed/electronic information aimed at the patient/consumer, family, caregivers, etc.
    - Reminders: the provision of information verbally, on papers or electronically to remind a patient/consumer to perform a particular health-related behaviors.
    - Mass media campaigns.
3. **For Nurses**
    - Educational meetings: lectures, workshops or traineeships, seminars, and symposia.
    - Educational materials: printed.
    - A trained person meets with nurses in their practice setting to provide information with the intention of changing the provider's practice.
    - Reminders: the provision of information verbally, on paper or on a computer screen to prompt them to recall information or to perform or avoid a particular action related to patient care.
    - Practice tools: tools designed to facilitate behavioral/practice changes.
4. **For Stakeholders**

    Plans have been made to contact with all the health sectors in Egypt including all sectors of the Ministry of Health and Population, National Nutrition Institute, University Hospitals, Ministry of Interior, Ministry of Defense, Non-Governmental Organizations, Private sector, and all Health Care Facilities.
    - Information and communication technology: Electronic decision support, order sets, care maps, electronic health records, office-based personal digital assistants, etc.
    - Any summary of clinical provision of health care over a specified period may include recommendations for clinical action. The information is obtained from medical records, databases, or observations by patients. Summary may be targeted at the individual practitioner or the organization.
    - Administrative policies and procedures.
    - Formularies: Drug safety programs, electronic medication administration records.
5. **Other activities to assist the implementation of the adapted guideline's recommendations include:**

- **International initiative:** Dissemination of the presented adapted CPG internationally via sending the final adapted CPG to the Guidelines International Network (GIN) Adaptation Working Group and contacting the CPG developers.
- **Gantt chart** has been designed to manage the dissemination and implementation stages for the adapted CPG over an accurate time frame (Appendix).

Guideline Implementation Tools

Educational materials based on this Adapted CPG for the Prevention and Management of Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents have been made available in several forms including:

1. Table summarizing guideline recommendations for health care workers
2. Tables for healthcare workers demonstrating : clinical presentation, risk factors, normal age- and gender-related red cell indices, lower limits for hemoglobin and hematoctrit values, dietary reference intake for iron, foods to increase iron intake and iron absorption, tips to optimize oral iron therapy, monitoring response to treatment.
3. Arabic Educational materials for nurses and mothers

Table 1: Summary of recommendations of the Egyptian pediatric clinical practice guidelines Prevention and Management of Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents.

Screening
Clinical screening for symptoms and signs of iron deficiency anemia, in infants and children, done by the primary health care professional/ pediatricians in primary health care setting/ OPC, improves the early detection of IDA and the neurodevelopmental outcome.
Clinical screening for symptoms and signs of iron deficiency anemia, in adolescent females, at yearly school visit, done by the primary health care professional/ pediatrician in primary health care setting/ OPC, improves the early detection of IDA.
Routine dietary history checklist, for iron containing food in infants, children and adolescents, without non-iron related comorbidities, done by the primary health care professional/ pediatrician in primary health care setting/ OPC, helps identify dietetic problems, improve the early detection of ID/IDA and neurodevelopmental outcome.
- There is no one test considered gold standard for diagnosing iron deficiency or IDA, so official recommendations vary. - There is no sufficient evidence to recommend specific screen tests for IDA. No studies evaluating the benefits or harms of screening programs for asymptomatic children.
- Laboratory screening of the general population for ID/IDA is not recommended. Laboratory testing of infants, children, and adolescents at high risk (identified by clinical screening i.e., symptoms and signs) is recommended.
Diagnosis**
Anemia is diagnosed if hemoglobin level is below the cut-off level for age and sex.
Microcytosis is diagnosed if mean corpuscular volume is below -2 SD for age related reference range.
Iron deficiency is considered if serum ferritin level is below 12 ug/L in all age groups in the absence of infection/ inflammation.
Iron deficiency is considered if serum ferritin level is below 30 ug/L in all age groups in the presence of infection/ inflammation.

Treatment
Oral iron therapy: Dose: 3-6 mg/kg / day for all ages Forms: syrup; tablets (each preparation contains different elemental iron dose) (not exceed maximum dose) Time: 1hour before or 2 hours after meals with Vitamin C at daytime Monitoring: after one month by CBC and reticulocytic count, then at 3, 6 months. If no response after one month: revise dose, compliance, tolerability, type of formula and consider change of formula for another month. Duration: for 3 months after recovery of hemoglobin. Tips for Oral iron intake - Lower and intermittent dose may be as effective and better tolerated. - To avoid gastric upset, can be taken at night, and increasing dose gradually. - Teeth staining can be avoided by brushing teeth and taking with water.
- If oral iron is ineffective or is not tolerated, consider other causes of anemia, and refer to Hematologist (avoid parenteral iron therapy). Packed RBCs should be considered after Hematologist opinion.
Nutritional support with iron rich formulas, solid food, and oral iron support 1-2 mg/kg/day elemental iron should be used to treat asymptomatic iron deficiency anemia in infants.
Referral
Referral to hematologist should be considered in cases of severe anemia, history of recurrent bleeding or with failure of increase in the hemoglobin concentration after proper iron dose and proper way of administration
Prevention of ID and IDA
Daily iron supplementation of 10-12.5 mg elemental iron daily (Drops/syrups) for three consecutive months is recommended as a public health intervention in infants and young children aged 6-23 months, living in settings where anemia is highly prevalent****.
Daily iron supplementation of 30 mg elemental iron daily (Drops/syrups/tablets) for three consecutive months is recommended as a public health intervention in preschool children aged 24 to 59 months, living in settings where anemia is highly prevalent****.
Daily iron supplementation of 30-60 mg elemental iron daily (Drops/syrups/tablets) for three consecutive months is recommended as a public health intervention in school aged children aged 5-12 years, living in settings where anemia is highly prevalent*****. Daily iron supplementation 30–60 mg elemental iron daily (Tablets), for three consecutive months in a year, is recommended as a public health intervention in menstruating adult women and adolescent girls, living in settings where anemia is highly prevalent*****, for the prevention of anemia and iron deficiency.
Dietary prevention • Start complementary feeding with iron rich food. • Avoid cow milk, goat milk, soy to infants under12 months of age. • From 12 months, cow milk should not exceed 500 ml per day. • For non-breast-fed infants, iron fortified formula can play a role in prevention and treatment of IDA.

Adapted from: "World Health Organization. (2016). Guideline: daily iron supplementation in adult women and adolescent girls. World Health Organization. https://apps.who.int/iris/handle/10665/204761", "Guideline: Daily iron supplementation in infants and children. Geneva: World Health Organization; 2016.",

"National Blood Authority (NBA) (2016). Patient Blood Management Guidelines: Module 6 – Neonatal and Paediatrics. NBA, Canberra, Australia."

Table 2: Clinical findings in iron deficiency/iron deficiency anemia.

Skin Pallor	**Nails** Koilonychia
Musculoskletal system Decreased effort capacity Exercise limitation	**Increased absorption of heavy metals** Lead intoxication
Cardiovascular system Increased cardiac output Tachycardia Cardiomegaly Heart failure	**Gastrointestinal system** Loss of appetite Angular stomatitis Atrofic glossitis Dysphagia Pica Gluten enteropathy Plummer-Vinson syndrome
Central nervous system Irritability-malaise Fainting Papilledema Pseudotumor cerebri 6th nerve palsy Restless leg syndrome Breath holding spell Sleep disturbance Attention deficit Learning difficulty Behavioral disorder Decrease in perception functions Retardation in motor and mental developmental tests	**Immune system disorders** Decreased resistance against infections T lymphocyte and polymorphonuclear leukocyte dysfunction

Aladhadhi AM, Etaiwi ST, Alqahtani KM, Bajafar AA, Nono AF, Aldrees SA, Almutawa SM, Alghraibi SA. Pediatrics Iron deficiency anemia from diagnosis to treatment. The Egyptian Journal of Hospital Medicine (October 2018) Vol. 73 (8), Page 7268-7273

Table 3a: Risk factors for IDA by cause.

3.1 Increased iron demands
• Prematurity • Infancy • Adolescence, especially in females Pregnancy

- Lactation
- Regular blood donation
- Competitive athletics

3.2 Diminished iron supply

- Prolonged breastfeeding without iron supplementation beyond the fourth month of life
- Consumption of infant formula low in iron
- Introduction of fresh cow's milk before the first birthday
- Daytime bottle use beyond the twelfth month of life
- Bottle use in bed
- Preferred consumption of poultry over red meat, vegan and vegetarian diets

3.3 Blood loss

- Traumatic or operative blood loss
- Gastrointestinal bleeding: Inflammatory bowel diseases (IBDs), stomach cancer, colon cancer, colonic polyps, non-steroidal anti- inflammatory drugs, chronic *Helicobacter pylori* infection, hookworm infection, angiodysplasia
- Gynecological bleeding: Menorrhagia, uterine fibroids, endometrial carcinoma, use of intrauterine devices over contraceptive pills for birth control
- Urological bleeding: Schistosomiasis, bladder cancer, glomerulonephritis, kidney trauma
- Pulmonary bleeding: Lung tuberculosis, congenital lung malformations, lung cancer, idiopathic pulmonary hemosiderosis, Goodpasture's syndrome, etc.
- Bleeding diathesis (congenital or acquired)

3.4 Malabsorption of iron

- Celiac disease (gluten sensitive enteropathy)
- Atrophic gastritis, gastric surgery
- Decreased gastric acidity (e.g., antacids, H2 blockers, protein-pump inhibitors)
- Iron Refractory Iron Deficiency Anemia (IRIDA)

Mantadakis E, Chatzimichael E, Zikidou P. Iron Deficiency Anemia in Children Residing in High and Low-Income Countries: Risk Factors, Prevention, Diagnosis and Therapy. Mediterr J Hematol Infect Dis. 2020 Jul 1;12(1):e2020041. doi: 10.4084/MJHID.2020.041. PMID: 32670519; PMCID: PMC7340216.

Table 3b: Main risk factors for IDA in low-income and developed countries.

Low-income countries	**Developed countries**
Prolonged breastfeeding without iron supplementation beyond the 4th month of life	Gastrointestinal bleeding of any etiology as per Table 3a

Limited consumption of meat and fish	Genitourinary bleeding of any etiology as per Table 3a
Diets rich on cereal, or legume-based flours, excess dietary fiber	Iron malabsorption of any etiology as per Table 3a
tea	
Multiparity	
Hookworm infestation	
Schistosomiasis	
Malaria (contributes to IDA by causing intravascular hemolysis with hemoglobinuria)	
Chronic or repeated infections (functional iron deficiency due to chronic inflammation)	

Mantadakis E, Chatzimichael E, Zikidou P. Iron Deficiency Anemia in Children Residing in High and Low-Income Countries: Risk Factors, Prevention, Diagnosis and Therapy. Mediterr J Hematol Infect Dis. 2020 Jul 1;12(1):e2020041. doi: 10.4084/MJHID.2020.041. PMID: 32670519; PMCID: PMC7340216.

Table 4: Normal age- and gender-related red cell indices for children

	Females and males				females			males		
Age (years)	1–1.9	2–4.9	5–7.9	8–11.9	12-14.9	15-17.9	>18	12-14.9	15-17.9	>18
RBC count Mean	4.34	4.34	4.41	4.52	4.47	4.48	4.42	4.71	4.92	4.99
-2SD	3.8	3.7	3.1	3.8	3.9	3.9	3.8	4.1	4.2	4.3
Mean Corpuscular volume Mean (fl)	79	81	82	84	86	88	90	85	87	89
-2SD	67	73	74	76	77	78	81	77	79	80

Based on the US second National Health and Nutrition Examination Survey (NHANES II) after excluding those with abnormal tests related to iron; Yip R, Johnson C, Dallman PR. Age-related changes in laboratory values used in the diagnosis of anemia and iron deficiency. *American Journal of Clinical Nutrition*, 1984, 39:427-436.

Table 5 : Lower limits for hemoglobin and hematoctrit values specified by the World Health Organization by age and gender

Groups by age and gender	Hemoglobin Hematocrit (g/dL) (%)	Hemoglobin Hematocrit (g/dL) (%)
Children aged between 6-59 months Children aged	11	33

between 5-11 years Children aged between 12-14 years Girls aged >15 years		
Boys aged >15 years	11.5	34
Children aged between 6-59 months Children aged between 5-11 years Children aged between 12-14 years Girls aged >15 years	12	36
Boys aged >15 years	12	36
Children aged between 6-59 months Children aged between 5-11 years Children aged between 12-14 years Girls aged >15 years	13	39

Özdemir N. Iron deficiency anemia from diagnosis to treatment in children. Turk Pediatri Ars. 2015 Mar 1;50(1):11-9. doi: 10.5152/tpa.2015.2337. PMID: 26078692; PMCID: PMC4462328.

Table 6: Dietary Reference Intake for Iron

LIFESTAGE GROUP	AI (mg/day)	UL (mg/day)	SELECTED FOOD SOURCES	ADVERSE EFFECTS OF EXCESSIVE CONSUMPTION	SPECIAL CONSIDERATIONS
Infants			Heme sources: meat, poultry, fish Nonheme sources: dairy, eggs, plant-based foods, breads, cereals, breakfast foods	GI distress	Persons with decreased gastric acidity may be at increased risk for deficiency. Cow's milk is a poor source of bioavailable iron and is not recommended for children <1 yr old. Neurocognitive deficits have been reported in infants with iron deficiency. RDA for females increases with menarche related to increased losses during menstruation. Vegans and vegetarians might require iron Supplementation or intake of iron fortified foods. GI parasites can increase iron losses via GI bleeds. Iron supplements can interfere with zinc absorption, and vice versa; if supplements are being used, the doses should be staggered.
0-6 mo	0.27	40			
7-12 mo	11	40			
Children					
1-3 yr	7	40			
4-8 yr	10	40			
Males					
9-13 yr	8	40			
14-18 yr	11	45			
19-21 yr	8	45			
Females					
9-13 yr	8	40			
14-18 yr	15	45			
19-21 yr	18	45			
Pregnancy					
≤18 yr	27	45			
19-21 yr	27	45			
Lactation					
≤18 yr	10	45			
19-21 yr	9	45			

AI: Adequate Intake, mo: month(s), RDA: Recommended Dietary Allowances, UL: Tolerable Upper Intake Levels, yr: year(s)

Adapted from “Food and Nutrition Board, US Institute of Medicine: Dietary reference intakes for water, potassium, sodium, chloride, and sulfate (website). http://www.nap.edu/openbook.php?record_id=10925 ; and Ross AC, US Institute of Medicine, Committee to Review Dietary Reference Intakes for Vitamin D and Calcium: Dietary reference intakes: calcium, vitamin D, Washington, DC, 2011, National Academies Press, pp xv, 536.”

TABLE 7 : Foods to Increase Iron Intake and Iron Absorption

	Elemental Iron, mg
Cereals	
Baby food, brown rice cereal, dry, instant, 1 tbsp	1.8
Baby food, oatmeal cereal, dry, 1 tbsp	1.6
Baby food, rice cereal, dry, 1 tbsp	1.2
Baby food, barley cereal, dry, 1 tbsp	1.1
Table food, heme iron	
Clams, canned, drained solids, 3 oz	23.8
Chicken liver, cooked, simmered, 3 oz	9.9
Oysters, Eastern canned, 3 oz	5.7
Beef liver, cooked, braised, 3 oz	5.6
Shrimp, cooked moist heat, 3 oz	2.6
Beef, composite of trimmed cuts, lean only, all grades, cooked, 3 oz	2.5
Sardines, Atlantic, canned in oil, drained solids with bone, 3 oz	2.5
Turkey, all classes, dark meat, roasted, 3 oz	2.0
Lamb, domestic, composite of trimmed retail cuts, separable lean only, choice, cooked, 3 oz	1.7
Fish, tuna, light, canned in water, drained solids, 3 oz	1.3
Chicken, broiler or fryer, dark meat, roasted, 3 oz	1.1
Turkey, all classes, light meat, roasted, 3 oz	1.1
Veal, composite of trimmed cuts, lean only, cooked, 3 oz	1.0
Chicken, broiler or fryer, breast, roasted, 3 oz	0.9
Fish, salmon, pink, cooked, 3 oz	0.8
Table food, nonheme iron	
Oatmeal, instant, fortified, cooked, 1 cup	14.0
Blackstrap molasses,[a] 2 tbsp	7.4
Tofu, raw, regular, ½ cup	6.7
Wheat germ, toasted, ½ cup	5.1

Ready-to-eat cereal, fortified at different levels, 1 cup	~4.5 to 18
Soybeans, mature seeds, cooked, boiled, ½ cup	4.4
Apricots, dehydrated (low-moisture), uncooked, ½ cup	3.8
Sunflower seeds, dried, ½ cup	3.7
Lentils, mature seeds, cooked, ½ cup	3.3
Spinach, cooked, boiled, drained, ½ cup	3.2
Chickpeas, mature seeds, cooked, ½ cup	2.4
Prunes, dehydrated (low-moisture), uncooked, ½ cup	2.3
Lima beans, large, mature seeds, cooked, ½ cup	2.2
Navy beans, mature seeds, cooked, ½ cup	2.2
Kidney beans, all types, mature seeds, cooked, ½ cup	2.0
Molasses, 2 tbsp	1.9
Pinto beans, mature seeds, cooked, ½ cup	1.8
Raisins, seedless, packed, ½ cup	1.6
Prunes, dehydrated (low moisture), stewed, ½ cup	1.6
Prune juice, canned, 4 fl oz	1.5
Green peas, cooked, boiled, drain, ½ cup	1.2
Enriched white rice, long-grain, regular, cooked, ½ cup	1.0
Whole egg, cooked (fried or poached), 1 large egg	0.9
Enriched spaghetti, cooked, ½ cup	0.9
White bread, commercially prepared, 1 slice	0.9
Whole-wheat bread, commercially prepared, 1 slice	0.7
Spaghetti or macaroni, whole wheat, cooked, ½ cup	0.7
Peanut butter, smooth style, 2 tbsp	0.6
Brown rice, medium-grain, cooked, ½ cup	0.5

a: Source of iron value was obtained from a manufacturer of this type of molasses.

Source of iron values in foods: US Department of Agriculture, Agricultural Research Service. USDA National Nutrient Database for Standard Reference, Release 20: Nutrient Data Laboratory home page. Available at: www.ars.usda.gov/ba/bhnrc/ndl.

Adapted from "Baker RD, Greer FR; Committee on Nutrition American Academy of Pediatrics. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age). Pediatrics. 2010 Nov;126(5):1040-50. doi: 10.1542/peds.2010-2576. Epub 2010 Oct 5. PMID: 20923825."

Table 8 : Selected Good Vitamin C Sources to Increase Iron Absorption

Fruits	Vegetables
Citrus fruits (eg, orange, tangerine, grapefruit)	Green, red, and yellow peppers
Pineapples	Broccoli
Fruit juices enriched with vitamin C	Tomatoes
Strawberries	Cabbages
Cantaloupe	Potatoes
Kiwifruit	Leafy green vegetables
Raspberries	Cauliflower

Baker RD, Greer FR; Committee on Nutrition American Academy of Pediatrics. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age). Pediatrics. 2010 Nov;126(5):1040-50. doi: 10.1542/peds.2010-2576. Epub 2010 Oct 5. PMID: 20923825.

Table 9: Plant foods that reduce iron absorption.

Oxalate-rich foods	Beverages: Coffee, tea (especially black tea) Cereals: Wheat bran Chocolate Fruits: Strawberries Herbs: Rhubarb, oregano, basil, parsley Vegetables: Beans, beets (roots and leaves), celery, spinach, kale Nuts: Peanuts Oilseeds: Soybeans
Polyphenol-rich foods	Beverages: Coffee, green tea, black tea, red wine, cider Cereals: Corn, wheat, rice, oat Cocoa Apples, blackberries, raspberries, blueberries, black currant, strawberry, kiwi, cherry, plum, pear, apricot, peach, black Fruits: grape, red grape Herbs: Rhubarb, peppermint, parsley Vegetables: Potato, red cabbage, yellow onion, tomato, broccoli, beans, green or white, chicory, artichoke, curly kale, leek, celery, capsicum pepper Nuts: Walnuts Oilseeds: Soybeans Spices
Phytate-rich foods	Cereals: Wheat, oats, rice, corn (maize), barley, sorghum, rye, millet, soybean Nuts: Walnuts, peanuts, nuts

	Oilseeds: Soybeans, linseed, sesame seed, sunflower meal Vegetables: Dried beans, lentils, peas, chickpeas
Calcium-rich foods	Fruits: Figs Herbs: Rhubarb Nuts: Almonds Oilseeds: Soya beans Vegetables: Broccoli, cabbage, okra, turnip greens, beans, kale

Mantadakis E, Chatzimichael E, Zikidou P. Iron Deficiency Anemia in Children Residing in High and Low-Income Countries: Risk Factors, Prevention, Diagnosis and Therapy. Mediterr J Hematol Infect Dis. 2020 Jul 1;12(1):e2020041. doi: 10.4084/MJHID.2020.041. PMID: 32670519; PMCID: PMC7340216.

Table 10: TIPS FOR OPTIMIZING ORAL IRON THERAPY

- Calculation of dosage should always consider *elemental iron* content of product.

- To maximize absorption, iron supplements should:
    - Be taken on an empty stomach with full glass of water or fruit juice, if appropriate (e.g., one hour before or two hours after meals).
    - Be taken in the morning or earlier in the day.
    - Be taken with a supplement or dietary source of Vitamin C (e.g., fruit juice, oranges, tomatoes).
    - NOT be taken with Calcium products (e.g.: supplements, certain antacids) or foods (e.g., dairy products such as milk, cheese, yogurt).
    - NOT be taken with high-oxalate foods (e.g., coffee, tea, spinach, kale, broccoli).

- Oral iron can cause nausea, vomiting, dyspepsia, constipation, diarrhea, metallic taste or dark stools. If your patient is experiencing GI based adverse effects, consider the following:
    - Start at a lower dose (e.g., one tablet once daily) and titrate up slowly (i.e., every four to five days).
    - Switch to liquid form for smaller dose titrations.
    - Switch to another preparation with less elemental iron.
    - Recommend taking iron with small snack or with meals (however food will decrease iron absorption by 40%).
    - Take at bedtime (however, iron absorption is lowest in evening when Hepcidin hormone levels are highest).
    - Could consider polysaccharide iron complex as an option however, it is more expensive and its effectiveness is no better than other iron salts.

Adapted from “Towards Optimized practice, Iron Deficiency Anemia, Clinical Practice Guidelines, March 2018. https://actt.albertadoctors.org/media/tc4lq52r/ida-cpg.pdf”

Table 11: MONITORING OF RESPONSE TO ORAL IRON THERAPY

Order a CBC and reticulocytes at two to four weeks to see if the patient is responding to replacement regimen.
Indicators of response to (i.e., targets for) iron therapy include: • Reticulocytosis in four days • Increasing hemoglobin >1gm/dl in four weeks
Correction of IDA should be observed within two to four months if appropriate iron dosages are administered, and underlying cause of iron deficiency is addressed.

Adapted from “Towards Optimized practice, Iron Deficiency Anemia, Clinical Practice Guidelines, March 2018. https://actt.albertadoctors.org/media/tc4lq52r/ida-cpg.pdf”


أعراض
نقص الحديد
في الجسم
برودة القدمين واليدين
أظافر ضعيفة
تململ الساقين
خفقان القلب
تورم وحرقة في الفم واللسان
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أفضل ١٠ أطعمة تحتوي على الحديد
لمحاربة الأنيميا
الفاصولياء البيضاء
العسل الأسود
بذور اليقطين
العدس
فول الصويا
اللحوم
حبوب القمح
الكبد
صفار البيض
السبانخ

Limitations and suggestions for further research needs

Future research recommendations for the Prevention and Management of Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents include:

- Implementation of strategies for screening ID/IDA among infants , children, and adolescents.
- Implementation of strategies to enforce prevention of ID/IDA among infants, children, and adolescents.

These recommendations aim to address specific challenges and characteristics of the Egyptian context, potentially leading to more effective prevention and management strategies for ID/IDA among infants , children, and adolescents.

Challenges

- Availability of inexpensive iron-rich dietary products.
- Availability of medicinal iron preparations for prophylactic and therapeutic use.

Strengthen the evidence base of the next update of this guideline by generating GRADE summary of finding tables, evidence profiles, and EtD frameworks.

Monitoring and evaluating the impact of the guideline.

- *The following is performance measure or indicator for implementing this adapted CPG for ID/IDA among infants , children, and adolescents:*

Adherence to ID/IDA Guidelines

- *Numerator:* Number of children with IDA who received treatment as per guideline recommendations.
- *Denominator:* Total number of children diagnosed with IDA
- *Data Source:* Hospital or clinic patient records.

These key performance indicators are designed to measure the effectiveness and adherence to the guidelines, the efficiency of the treatment in terms of resource utilization (hospital stay), and the success of the treatment in preventing further complications (readmissions).

Updating of the guideline

The EPG …GAG has decided to conduct the next review of this adapted CPG for updates after five years. This should be carried out in 2025 after checking for updates in the source CPGs, consultation of expert opinion on the changes needed for updating according to the newest evidence and recommendations published in this area and the clinical audit and feedback from implementation efforts in the aforementioned local healthcare settings except if any breakthrough evidence- based recommendations are published before that date. The process will be guided by the Checklist for the Reporting of Updated Guidelines (CheckUp) Tool that is freely provided by the AGREE Enterprise and by the Reporting Items for Practice Guidelines in Healthcare (RIGHT) extension for adapted guidelines RIGHT-Ad@pt Checklist.

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Annexes

Annex Table 1.

Declaration of Conflict of Interests

The members of the guideline development/ adaptation group and the external review group have no academic, financial, or competing interests to declare and none of them were involved in the development of the original source guideline(s).
Any identified potential COI has been reported below.

Egyptian Pediatric Clinical Practice Guidelines Committee (EPG) ***Guideline Adaptation Group (Clinical subgroup)***			
Name	**Affiliation, Area of expertise / Role, Country / Primary location [work]**	**Declaration of interests**	
		Interest identified	**Management plan & decision**
Prof. Galila Mokhtar	Professor of Pediatrics, Pediatric Hematology and Oncology unit, Ain Shams University	None	Not Applicable
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Professor Ahmed Mansoor	Almansoura University	None	Not Applicable
International Peer Reviewers			
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Web annexes

The following annexes can be added as a package of standalone supplementary documents.

Keywords: The MeSH terms for "Guideline for the prevention and management of iron deficiency and iron deficiency anemia in infants, children and adolescents" on PubMed are: Anemia, Iron-deficiency, Pediatrics