Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2021 18(4):3201-3207. **OPEN ACCESS**

Prevalence of iron insufficiency anemia amongst non-pregnant, childbearing age females resides in Al-Salt City, Jordan

Maisa M. A. Al-Qudah[1], Ola M.Al-Sanabra[1], Jafar M. F. El-Qudah[2, 3*], Ammar S. Ali Deeb[4], Hashem A. Abu-Harirah[4], Kawther Amawi[4] and Fawzi Al-Dabbas[3]

[1]Department of Medical Laboratory Sciences, Faculty of Science, Al-Balqa Applied University, Al-Salt 19117, **Jordan**
[2]Department of Diet Therapy Technology and Dietetics, Faculty of Allied Medical Sciences, Zarqa University, Al-Zarqa, **Jordan**
[3]Department of Nutrition and Food Processing, Faculty of Agricultural Technology, Al-Balqa Applied University, Al-Salt, 19117, **Jordan**
[4]Department of Medical Laboratory Sciences, Faculty of Allied Medical Sciences, Zarqa University, Al-Zarqa, **Jordan**

***Correspondence:** jqudah@zu.edu.jo **Received 28-10-2021, Revised: 13-12-2021, Accepted: 15-12-2021 e-Published: 20-12-2021**

Iron deficiency anemia remains a considerable prevalent common health issue with significant influence on human health as well its burden precisely on the low socioeconomic status countries. A cross-sectional study was conducted during the period of (2014-2015) to estimate the prevalence of iron insufficiency anemia (IDA) amongst non-pregnant women from Al-Salt city. Blood samples were collected from 150 non-pregnant women aged between 18-50 years using sterile needles from vein or lancet from finger-break stab to assess their hemoglobin concentration and packed cell volume levels, respectively. Each participant in this study was inquired to complete a questionnaire concurrently to blood phlebotomy time. The overall prevalence of IDA in the studied samples of non-pregnant women was 23%. Additionally, this study showed that more than one-third of the samples were overweight or obese (20.9% and 13.9%), respectively. The mean daily intake of energy, iron, and vitamin C among anemic women was low compared to non-anemic women (1126 Kcal vs. 1577 Kcal, 9.45mg vs. 13 mg, and 33.6 mg vs. 87.4 mg), respectively. Therefore, the results from this study showed a high prevalent of IDA amongst non-pregnant women who lives in Al-Salt city. Moreover, this type of anemia is associated with a low intake of iron along with vitamin C, so this emphasis the importance of iron bioavailability for this population category by both boosting their intake of iron-rich food alongside ingestion of food that enhances the iron absorption. In conclusion, the present study illustrates the prevalence of IDA among women in Al-Salt city, including those of childbearing age either due to the low intake of iron-rich food or problems associated with iron absorption. Thus, educational programs are needed for women to combat IDA and enhance their eating patterns, with special emphasis on the importance of intake iron-rich foods as well as the significance of ingestion foods, which enhance the absorption of iron.

Keywords: Iron deficiency anemia (IDA), Hemoglobin, non-pregnant women, Al-Salt city, Jordan.

INTRODUCTION

Iron deficiency anemia remains a prevalent common health issue with significant influence on human health as well it burdens the socioeconomic status of countries worldwide (World Health Organization, 2001;World Health Organization, 2004). Moreover, previous studies have shown that the prevalence of IDA is increased among different

population groups due to different etiologies (World Health Organization, 2015). Precisely, the increase in IDA cases was documented among women group whom in childbearing age, which could be a leading reason for increasing the mortality risks of maternal and child morbidity. Furthermore, the critical influence of IDA on the physical development and cognitive of children and adults work productivity is a significant concern. The increasing risks of IDA in this group were revealed to be associated with the severity of this illness (Killip S et al. 2007; Saydam BK et al. 2017).

The cause of IDA is the low iron levels in the three iron compartments within the individual body(Elaine Keohane et al. 2020). This low level of iron is due to several causes such as nutrient deficiency, malabsorption, genetic disorders, infectious disease, microbial infections, parasitic infections, and chronic diseases (World Health Organization, 2001; Culleton BF et al. 2006).

Iron deficiency anemia appears to be high and widespread amongst Jordanian females more than a third (35%) of non-pregnant females experience iron deficiency (Mohammad A, Salahat, 2012). Anemia continues to be a moderate health problem since the prevalent among non-pregnant females reached 31%, iron insufficiency anemia affects one woman out of five(Rasha Arabyat et al. 2019). Thus, IDA is a major determinant of anemia in Jordanian women. Epidemiological studies showed that IDA is more prevalent in rural areas and the South region (Samiha S Jarrah et al. 2007; Jordan Population and Family Health Survey 2017).Both Jordan Population and Family Health Survey for 2002 and 2009, which included all women, showed prevalent anemia of about 25% (Jordan Population and family health survey, 2017).

A micronutrient study showed that 14% of females aged 15-49 had a folate insufficiency, and 11% had a vitamin B12 insufficiency (National Micronutrient Survey, 2011).These nutritional deficiencies are the main cause of anemia (Food and Nutrition profile, 2011). According to a national survey on anemia conducted in Jordan in late 2002 reported that 32.3% of women of childbearing age have the anemia prevalence, with 70% of anemia being due to iron insufficiency. (Serdula et al. 2014).

The main aim of this study was to assess the hemoglobin level in samples taken from non-pregnant women aged 18-50 years living in Al-Salt city to see the association between hemoglobin concentration and their mean daily intake of iron, vitamin C, and energy.

MATERIALS AND METHODS

1. The Sample

Illustrative samples of randomly 150 non-pregnant women were designated to conduct this study between 2014-2015. All participants were recruited to participate in this study according to the inclusion and exclusion criteria table (1).

2. Data collection

A Questionnaire was designed to collect data from women, who have been included in this study, and it was divided into two parts, the first part is general questions about age, weight, height, educational degree and maternal status. The second part is a 24-hour recall to know what they have eaten between 1 to 3 days since the beginning of the study. Afterward, these data were analyzed using the United States Department of Agriculture Database, super tracker, and food exchange system (United States Department of Agriculture. Super Tracker. Access on 2017).To estimate the amount of iron, vitamin C, and energy, then data were compared with the mean intake with the Dietary Reference Intake(DRI)(Dietary Reference Intakes for Calcium and Vitamin D, 2011).

3. Blood samples

Blood samples from the female participants who match the inclusion criteria and exclusion criteria in this study were collected by performing a vein puncture to collect (3 ml) or capillary finger-breaking puncture using either sterile needle or lancet for assessment of their hemoglobin concentration and Packed cell volume (PCV).

4. Determination of hemoglobin (Hb) concentration and Packed cell volume parameters

Assessment of hemoglobin concentration was carried out by running the collected blood samples in midrange automatic Hematology Analyzer (BC-2800, Germany. Hematocrit was measured according to the standard procedure and using Remi, RM 12C laboratory centrifuge (India).

5.The cut-off level of anemia

To determine the anemic females depends on the hemoglobin level a normal range for the measured hemoglobin concentration in females category age (18-60 years old) were considered to be **(**12– 6 gm/dl) (Abbassi-Ghanavati M etal.2009).

Table1: Inclusion and Exclusion criteria

Participants Criteria	Inclusion criteria	Exclusion criteria
Gender	Females	Males
Age	18-50 Years old	≤18 or ≥ 50 years old
Educational status	Broad range	-
Pregnancy status	Non-pregnant	Pregnant
Regularity of menstrual cycle occurrence	Regular	Irregular
Menstruation status including amount of blood flow during each menstrual cycle	Normal	Little or heavy
History of concurrent chronic diseases	No	Yes
History of concurrent hemorrhage disorders	No	Yes
Medications intake including contraceptive drugs	No	Yes
Hormonal therapy intake	No	Yes
Supplements intake (Iron or vitamin C)	No	Yes
Smoking status	No	Yes
Occupation	Diverse	-
Previous knowledge about their anemic status	No known whether anemic or normal	Know they are anemic

6. Body Mass Index (BMI) Calculations

We considered the normal range of BMI as in table (2) according to the standard measurements that were previously documented (Mahan, L.K. and Escott-Stump, S., 2011).

Table 2: BMI categories for non-pregnant

Category	Normal range
Under weight	< 18.5
Normal weight	18.5 – 24.9
Overweight	25 – 29.9
Obese	>= 30

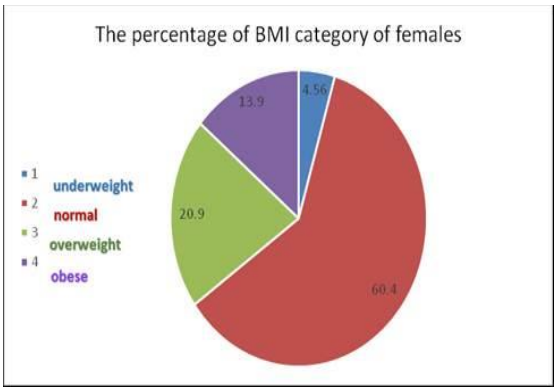

Figure 1: The distribution of the sample based on BMI categories of females(n=150).

7. Statistical analysis

Statistical analysis was performed using SPSS, version 15.0. Descriptive statistics were used, and data were presented as means± standard deviation (M ± SD), median frequencies, and percentages.

RESULTS

The present analysis shows that the prevalence of anemia was relatively high, about 23% of non-pregnant females were anemic.

Figure (1) shows the distribution of the samples based on BMI categories of females(n=150) when 20.9% of the samples were overweight and 13.9% were obese.

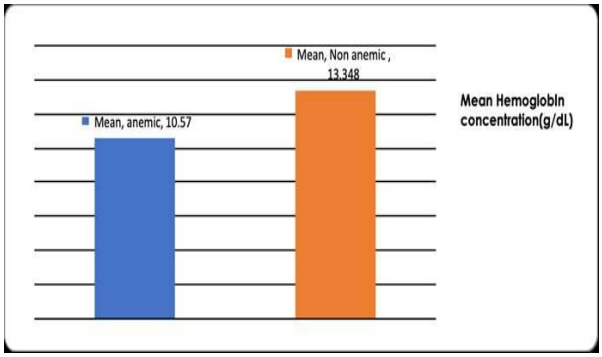

Figure 2: mean hemoglobin concentration for

anemic and non-anemic females

Figure (2) shows that the mean hemoglobin concentration for the anemic non-pregnant female is 10.5g/dl and for non-anemic is 13.3g/dl. About three-quarter of non-pregnant female was non-anemic and one quarter was anemic Figure(3).

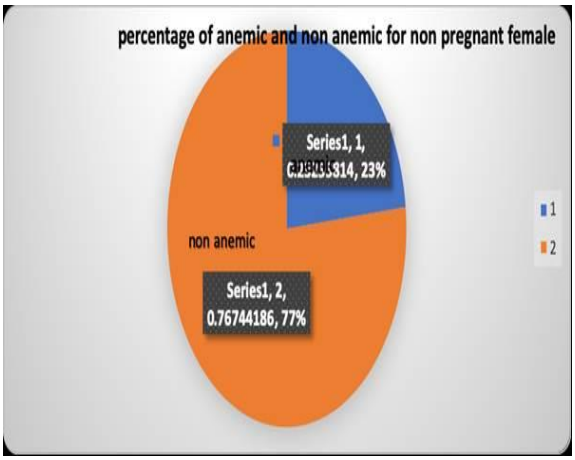

Figure 3: Percentage of anemic and non-anemic females

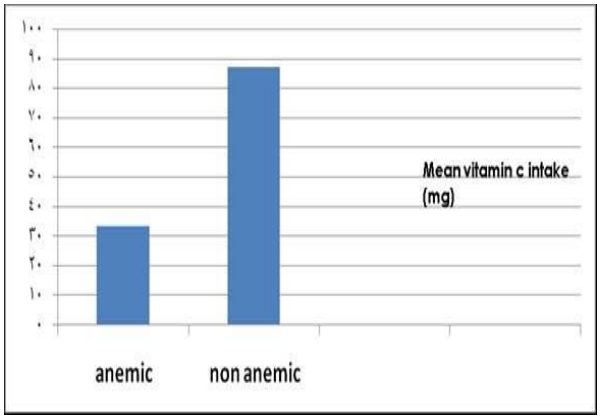

Figure 4: Mean vitamin C intake

Figure (4) shows that the mean vitamin C intake of the anemic non-pregnant female is 33.6mg and for non-anemic is 87.4mg. The mean daily intake of iron and vitamin C among anemic women was low compared to non-anemic women.

The mean daily iron intake of anemic non-pregnant women was 9.45 ± 1.14 and within non-anemic was 13.13 ± 1.28. More than three-quarters of non-pregnant females consume iron under RDA and about one-eighth consume iron over RDA figure (5).

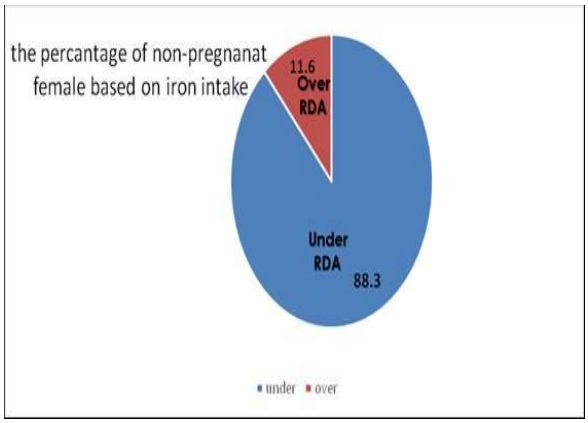

Figure 5: Percentage of Iron intake compared with the RDA

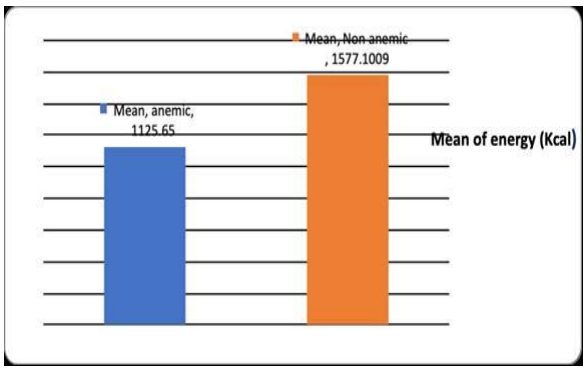

Figure 6: Mean energy intake

Figure (6) shows that the mean energy intake for anemic non-pregnant is less than non-anemic, for anemic was about 1125.65 Kcal and for non-anemic was about 1577 Kcal.

DISCUSSION

In many regions, the burden of anemia is still persistently high despite reductions in anemia prevalence globally (William Gardner et al. 2019).

The overall mean hemoglobin concentration in this study was found to be 12.71 g/dL for non-pregnant. These results agreed with previous studies (Qatatsheh et al. 2016;Abu-Baker et al. 2021).Comparable to a study which was conducted in Jordan in 2021, the researchers found that the prevalence of anemia among the 290 participants who agreed to take blood tests, the mean hemoglobin level was 11.68. Where 45.5% of the participants had a normal level according to the laboratory results. In contrast, 10% had moderate anemia and 44.5% had mild anemia, when none of the participants had severe anemia (Abu-Baker et al. 2021).

A study conducted in Jordan showed that anemia prevalence was 27.4% in pregnant females,19.3% in non-pregnant, and 4.9% in males. Prevalence rates according to age were 19.3% in females and 4.9% in males. Anemia was mostly mild (pregnant females 65.2%, non-pregnant females 57%, and males 81%). Education, age, sex, marital status, and region were significantly associated with anemia. Iron deficiency anemia (IDA) is the reason for 38% of anemic males and 68% of anemic females (Abdo. N et al. 2019).

Anemia prevalent amongst the non-pregnant females in this study was high, maybe because lactating mothers completing their pregnancy with depleted iron stores become under the burden of lactation, which is nutritionally needed. During the lactation period, the absence of menstrual blood loss is, somehow, offset by the secretion of 0.3 mg iron/day in breast milk as well as to the basal losses (WHO 2015). On the other hand, the high fertility rates and greater loss of menstrual blood was probably the main cause of anemia high prevalence in the present study. These findings are consistent with previous results of population-based studies in Middle East countries and Africa (Jemal, 2010; M Rezk et al. 2015).

Another study was conducted at King Abdulaziz University in Jeddah city in Saudi Arabia among apparently healthy young female students found that 23.9% of samples had iron deficiency anemia and 25.9% of the students had insufficient iron store (Al-Sayes et al. 2011).

A study was conducted by (Abdo. N et al. 2019) found that the anemia prevalent was 19.3 % in Jordan, which differs from this study results due to different Governorate, food habits, incomes, and general habits.

The present study has some important limitations. First, this study is based on hemoglobin concentration which alone, without serum iron and ferritin results and biochemical markers such as transferrin, iron-binding capacity, or hematocrit, can determine the severity of insufficiency. Second, the small sample size of the studied population. Third, self-reported surveys may entail response biases. Finally, the study results were restricted due to the participants were from one city in the middle region of Jordan.

CONCLUSION

The prevalence of anemia in the samples was relatively high. It appears that iron deficiency anemia is high and widespread among Jordanian women. It appears that low intake of iron and vitamin C was positively associated with anemia and further study is needed due to the small sample size also nutrition intervention program is needed for women to combat iron deficiency anemia with special emphasis on the importance of iron-rich food, and the importance of consuming food that enhances the absorption of iron.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

The researchers are very grateful to the females who participated in the study.

AUTHOR CONTRIBUTIONS

MA, OMA and JME designed and performed the experiments and also wrote the manuscript. ASD, HAA, KA, FA reviewed the manuscript. All authors read and approved the final version.

REFERENCES

Abbassi-Ghanavati M, Greer LG, Cunningham FG. (2009). Pregnancy and laboratory studies: a reference table for clinicians. Obstet Gynecol. Dec;114(6):1326-31. https://perinatology.com/Reference/Reference%20Ranges/Hemoglobin.htm.

Abdo N; Douglas S; Batieha A; Khader Y; JaddouH; Al-Khatib S; et al. (2019). The prevalence and determinants of anaemia in Jordan. East Mediterr Health J.;25(5):341-349 https://doi.org/10.26719/emhj.18.047 Received: 16/01/18; accepted: 14/06/18.

Arabyat R, Arabyat G, Al-TaaniG.East Mediterr. (2019). Health J. Oct 7;25(8):543-552. doi: 10.26719/emhj.18.074.PMID: 31612968.

Abu-Baker, Nesrin N. Eyadat, Anwar M. Khamaiseh, Abdullah M. (2021).The impact of nutrition education on knowledge, attitude, and practice regarding iron deficiency anemia

among female adolescent students in Jordan.Heliyon 7 (2021) e06348.https://doi.org/10.1016/j.heliyon.2021 .e06348older adults.Blood. 2006 May 15;107(10):3841–6. http://dx.doi.org/10.1182/blood-2005-10- 4308 phosphatase activity. Jordan Journal of Biological Sciences. Mar;5(1):65–70.

Al-Sayes, Fatin, MamdoohGari, Safaa Qusti, Nadiah Bagatian and Adel Abuzenadah.(2011). Prevalence of iron deficiency and iron deficiency anemia among females at university stage.Journal of Medical Laboratory and Diagnosis Vol. 2(1) pp. 5-11. Available online http://www.academicjournals.org/JMLD

Carter RC, Jacobson JL, Burden MJ, Armony-Sivan R, Dodge NC, Angelilli ML, et al. (2009). Iron deficiency anemia and cognitive function in infancy. Pediatrics. 2010 Aug 1;126(2): e427–34. http://dx.doi.org/10.1542/peds. 2097 and pregnant women in Jordan.J TranscultNurs. 2007 Jan;18(1):19–27. http://dx.doi.org/10.1177/104365960629419.

Clinical Principles and Applications.(2007). World Health Organization; 6th Edition. Saunders, 2013, PP 904, Hardcover ISBN: 9780323530453, eBook ISBN: 9780323549639 Consultation on the assessment of iron status at the population level. Geneva.

Culleton BF, Manns BJ, Zhang J, Tonelli M, Klarenbach S, Hemmelgarn. (2006). BR Impact of anemia on hospitalization and mortality in older adults. Blood 107: 3841-3846.

Dietary Reference Intakes for Calcium and Vitamin D. (2011). IOM (Institute of Medicine), 1997/2005 and Washington, DC: The National Academies Press. Available at: http://www.nap.edu/openbook.php?record_id =13050&page=R2

Elaine Keohane, Catherine Otto, Jeanine Walenga. (2020). Rodak's Hematology. Clinical Principles and Applications. 6th edition. Food and nutrition profile, (2011). Jordan Nutrition and Consumer Protection Division,FAO. http://www.fao.org/3/aq039e/aq039e.pdf . https://www.who.int/nutrition/publications/WH OandUNICEF_statement_anaemia.pdf. Iron deficiency anaemia: assessment, prevention and control, A guide for programme managers. Geneva, World Health Organization, 2001. https://www.who.int/nutrition/publications/en/i da_assessment_prevention_control.pdf

Jemal H.,(2010). Prevalence of anaemia, deficiencies of iron and folic acid and their determinants in Ethiopian women. Journal of Health, Population and Nutrition 28:359–368.

Jordan Population and Family Health Survey. (2017). Department of Statistics Amman, The DHS Program - ICF. -18. 2019;1–345. Available from: https://www1.wfp.org/publications/wfp-jordan-comprehensive-food-security-and vulnerability-assessment-2018.

Killip S, Bennett JM, Chambers MD. (2007). Iron deficiency anemia. Am Fam Physician. Mar 1;75(5):671-8 PMID: 1737551.

Mahan, L.K. and Escott-Stump, S., (2011), Krause's Food, Nutrition and Diet Therapy, 12th ed., international edition, W.B. Saunders Company, Philadelphia Mar;33(2):433. 10.12669/pjms.332.11771.

Mohammad A, Salahat I. (2012). Prevalence of anemia among Jordanian pregnant women and the effect of early pregnancy on alkaline. Jordan Journal of Biological Sciences 5(1): 65 – 70.

National Micronutrient Survey.(2011). Kingdom of Jordan Ministry of Health, Jordan 2010. Ministry of Health; Amman: http://www.gainhealth.org/reports/national-micronutrient-survey-jordan.

Qatatsheh, A. A. Dabbour, I. R. Al-rethaia, A. S. Al-Holy, M. A. Omar S. S. Progress in Nutrition (2016). Iron status in healthy subjects living in Jordan.; 18(3): 242-248.

Rasha Arabyat , Ghaith Arabyat , Ghaith Al-Taani. (2019).Prevalence and risk factors of anaemia among ever-married women in Jordan. East Mediterr Health J 25 (8): 543-552.

Rezk M, Marawan H, Dawood R, Masood A, Abo-Elnasr M. (2015).Prevalence and risk factors of iron-deficiency anaemia among pregnant women in rural districts of Menoufia governorate, Egypt. J Obstet Gynaecol. 35(7):663-6. doi: 10.3109/01443615.2014.991289. Epub 2015 Feb 2. PMID: 25643259.

Samiha S Jarrah , Jehad O Halabi, A Elaine Bond, Joann Abegglen. (2007). Iron deficiency anemia (IDA) perceptions and dietary iron intake among young women and pregnant women in Jordan. J Transcult Nurs,

18(1):19-27.

Saydam BK, Genc RE, Sarac F, Turfan EC. (2017). Prevalence of anemia and related factors among women in Turkey.Pak J Med Sci.

Serdula, M. K., Nichols, E. K., Aburto, N. J., Masa'd, H., Obaid, B., Wirth, J., Tarawneh, M., Barham, R., Hijawi, B., Sullivan, K. M. (2014). Jordan Fortification Working Group,& Jordan Fortification Working Group Micronutrient status in Jordan: 2002 and 2010. European journal of clinical nutrition, 68(10), 1124–1128. https://doi.org/10.1038/ejcn.2014.100.

United States Department of Agriculture.Super Tracker.Access on (2017). Available at: http://www.choosemyplate.gov/supertracker-tools/supertracker.html.

William Gardner, Nicholas Kassebaum, (2019). Global, Regional, and National Prevalence of Anemia and Its Causes in 204 Countries and Territories, 1990–Current Developments in Nutrition, Volume 4, Issue Supplement_2, June 2020, Page 830, https://doi.org/10.1093/cdn/nzaa053_035.

World Health Organization (WHO) (2015).The Global Prevalence of Anemia in 2011.World Health Organization; Geneva, Switzerland.

World Health Organization (WHO) (2004). Focusing on anaemia: towards an integrated approach for effective anaemia control: joint statement by the World Health Organization and the United Nations Children's Fund. Geneva.

World Health Organization, (2001). Department of Nutrition for Health and Development Iron Deficiency Anaemia: Assessment, Prevention and Control: A Guide for Programme Managers. Geneva: WHO. World Health Organization. Report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical.