Original Article

Frequency of Anemia/IDA and Associated Risk Factors Among Working Women of a Medical Center in Tehran, Iran: A Cross-Sectional Study

Giti Noghabaei, Maliheh Arab[1], Sara Payami[2], Behnaz Ghavami[3], Behnaz Nouri[4], Roya Parkhideh[5]

Internal Medicine Department, Imam Hossein Hospital Complex, Iran University of Medical Sciences, Tehran, [1]Obstetrics and Gynaecology Department, Imam Hossein Medical Centre, Shahid Beheshti University of Medical Sciences, Tehran, [2]Emergency Medicine Department, Ziaeian Hospital, Tehran University of Medical Sciences, Tehran, [3]Obstetrics and Gynaecology Department, Arash Women`s Hospital, Tehran University of Medical Sciences, Tehran, [4]Obstetrics and Gynaecology Department, Shohada-e-Tajrish Hospital Clinic, Shahid Beheshti University of Medical Sciences, Tehran, [5]Cardiology Department, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran

Abstract

Introduction: The study aimed to examine anemia prevalence and risk factors in employed women at a medical center compared to unemployed women from a charity center, with anemia defined as hemoglobin <120 g/L and iron deficiency as serum ferritin <30 ng/mL or serum iron <10 mcg/dL. **Material and Methods:** This cross-sectional study included 651 employed, non-pregnant randomly selected women aged 20–67 years. Participants completed questionnaires on sociodemographic, nutritional, and obstetrical characteristics. Blood indicators such as hemoglobin, serum ferritin, iron, and TIBC were measured. **Results:** Out of 651 participants, 395 (60.7%) had anemia/IDA (Hb <120 g/L, ferritin <30 ng/mL, or iron <10mcg/dL), comprising 308 (47.3%) having IDA and 215 (33%) having anemia. Younger age (<40 years) and menorrhagia were individually associated with 1.84- and 2.79- times increased risk of developing anemia in the studied population, respectively. A higher number of shifts and lack of vegetable consumption were found to be significantly prevalent in the anemic group. The prevalence of anemia/IDA among hospital staff and referred women was 60.7% and 43.1%, respectively. **Conclusions:** The study emphasized the influence of employment on the prevalence of anemia/IDA among hospital staff compared to unemployed women.

Keywords: Dietary intake, iron deficiency anemia, menorrhagia, occupational health, working women

Introduction

Iron deficiency anemia (IDA) is widely acknowledged as a major issue that affects socioeconomic development, especially in countries with limited resources, due to its detrimental effects on physical and cognitive efficiency.[1,2] Recent reports indicate a 33.7% prevalence of anemia among women of childbearing age worldwide in 2021.[3] In 2019, the prevalence of anemia among women of reproductive age in Iran, namely those aged 15–49 years, was reported to be 24%.[4] IDA is responsible for more than 60% of anemia cases worldwide.[5] WHO defines anemia as blood hemoglobin concentration <120 g/L in adult non-pregnant women.[6] Isolated IDA in adults is defined as serum ferritin <30 ng/mL or serum iron level <10 mcg/dL, which may exist in the absence of low hemoglobin.[6-8] Severe iron shortage may occur even in the presence of normal hemoglobin levels and a complete blood count. The incidence of iron deficiency is noted to be 2.5 times higher than anemia as anemia is considered a late index of iron deficiency and IDA is a delayed indicator of iron deficiency.[9,10]

Anemia negatively impacts working women's physical and mental capacity, leading to diminished cognitive concentration.[2,11,12] It can also cause reproductive health issues.[13] The most common precipitating factors for IDA are menstrual bleeding, abnormal uterine bleeding, and

Access this article online

Quick Response Code:

Website: www.ijcm.org.in

DOI: 10.4103/ijcm.ijcm_404_23

Address for correspondence: Dr. Maliheh Arab, Imam Hossein Medical Centre, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
E-mail: drmarab@sbmu.ac.ir

How to cite this article: Noghabaei G, Arab M, Payami S, Ghavami B, Nouri B, Parkhideh R. Frequency of anemia/IDA and associated risk factors among working women of a medical center in Tehran, Iran: A cross-sectional study. Indian J Community Med 2024;49:759-63.

Received: 18-06-23, **Accepted:** 19-04-24, **Published:** 14-08-24

gastrointestinal bleeding.[14] A variety of epidemiological factors have been linked to the development of anemia in females of childbearing age: age range of 30–39 years, smoking, low socioeconomic status, and lack of education.[8,15] Recent evidence suggests that iron-enriched regimens, proteins, vitamins, and minerals (e.g. copper and zinc) can enhance the replenishment of iron stores, while dietary intake of phytate, oxalate, tannins, and fiber reduce iron absorption.[16] While the precise explanation of the higher prevalence of anemia among working women is unknown, several variables, including stress, workload, economic problems, workplace conditions, and employment, may be involved.[17]

The current study was designed to examine the prevalence of anemia/IDA in female hospital workers, evaluate the variables associated with its development among our study sample, and compare it with those of unemployed women referred from a charity center.

Material and Methods

In this prospective cross-sectional study, 651 women employed at the Imam Hossein Medical Center were assessed for anemia by using the WHO criteria. Anemia was defined as hemoglobin <120 g/L, serum ferritin <30 ng/mL, or iron <10 mcg/dL. The participants were all healthy non-pregnant, non-lactating women, regardless of their age, and without any clinical features of anemia. The research excluded pregnant women, recent surgery patients, and those with certain health conditions. Data on demographics, reproductive history, nutrition, and other potential factors for anemia development were collected and analyzed using SPSS software version 21. Relevant hematological indicators, including hemoglobin (Hb), serum ferritin, iron, and TIBC, were measured.

The study compared anemia prevalence in working women to that in unemployed women from the community. Multivariate logistic regression analysis was conducted to identify associations between anemia and various variables, with significance set at $P < 0.05$. The study was conducted with approval from the Ethics Committee/Institutional Review Board (IRB) of the Shahid Beheshti University of Medical Sciences, by the Helsinki Declaration of 1975, as revised in 2000, and informed consent from participants, in line with ethical guidelines.

Results

The study found that 60.7% of 651 female medical center staff suffer from anemia/IDA, with ferritin <30 ng/mL, iron <10 mcg/dL, and/or Hb <120 g/L, with 308 (47.3%) suffering from IDA and 215 (33% having Hb concentrations <120 g/L). The details and comparison of variables of anemic and non-anemic participants are given in Table 1. Anemia was more prevalent in those under 40 years old, with menorrhagia, more work shifts, and lack of vegetable consumption being more prevalent. The study also found that 14.7% of participants experienced heavy menstruation, compared to 18% in the anemic group. The variables of menorrhagia, number of shifts, vitamin D deficiency, and age, which were in the univariate analysis with *P*- value <0.1, were modeled in the multiple logistic regression model. It was found that with control of effect on each of these variables, menorrhagia increased the risk of anemia by 2.79 times, and by increasing one unit to work shift, the risk increased significantly. Having menorrhagia among female staff of the medical center increased the risk of anemia (OR = 1.84 (1.17–2.88); $P = 0.008$). The risk of anemia among women under 40 years was 1.84 times higher than that among women over 50 years (OR = 1.84 (1.07–3.19); $P = 0.029$), and the risk of anemia among women who did not eat vegetables was 1.64 times higher than that in women who did (OR = 1.64 (1.06–2.54); $P = 0.026$) [Table 1].

The prevalence of anemia in female staff of the studied medical center was compared with those of unemployed women referred from a charity center to the medical center. As shown in Table 2, 33% of the hospital staff suffered from anemia, while this rate was 18.9% for the patient group referred from the charity center. For the hospital staff group and the charity group, the combined incidence of anemia or IDA was 60.7% and 43.1%, respectively [Table 2].

Discussion

The study found that 60.7% of 651 female medical center staff suffer from anemia/IDA. The mean age of participants in the present study was 36.58 ± 8.90 years, with the age range of 20–39-year-old participants shown to be the most vulnerable age group for developing anemia. Research shows that hemoglobin concentration in red blood cells may be influenced by women's knowledge about anemia and its symptoms, dietary patterns, employment status, and stress-related variables.[18] We evaluated the correlation of anemia risk factors by logistically regressing patient characteristics and dietary variables with anemia status. The statistical studies of anemic and non-anemic women in various age groups, menstrual history, work shifts, and vegetable intake disclosed a significant difference. The study found that women under 40 years old are 1.84 times more likely to develop anemia than those over 50. The high prevalence of anemia in our study population is multifactorial. Our study population consisted of female staff employed at the medical center; factors such as rotating shifts, coexisting family-related responsibilities, reproductive factors such as heavy menstruation, workplace stress, and having limited time to care for own health could be contributing to the issue in this population.

The present study revealed that menorrhagia increased the risk of anemia by 2.79-fold, while 14.7% of the studied participants and 18% of the anemic cases suffered from heavy menstruation. Heavy menstrual bleeding is an often disregarded and under-researched factor contributing to IDA in women of childbearing age, with reported incidences reaching up to 50%.[19] In the present study, there was a significant difference ($P = 0.026$) in the proportion of vegetable intake

Table 1: Description and comparison of variables according to anemia status

Variable	Anemia/IDA		Total	*P*	OR (95%CI)
	No	Yes			
Age mean±SD	37.38±9.45	36.07±8.50	36.58±8.90	0.066	0.984 (0.966–1.001)
Hb mean±SD	12.78±0.616	11.24±0.760	12.27±0.990	<0.001	
Iron mean±SD	93.91±33.21	81.87±38.96	86.61±37.25	>0.001	
Ferritin mean±SD	63.22±61.72	27.25±30.93	41.39±48.82	>0.001	
TIBC mean±SD	310.4±36.75	325.7±42.58	319.68±41.05	<0.001	
Vit D mean±SD	23.28±24.89	20.61±16.61	22.39±22.52	0.162	0.994 (0.985–1.00)
Education				0.862	
Undergraduate	13 (5.1)	16 (4.1)	29 (4.5)		
Diploma	68 (26.6)	107 (27.1)	175 (26.9)	0.543	1.28 (0.579–2.82)
Bachelor's	158 (61.7)	250 (63.3)	408 (62.7)	0.516	1.29 (0.602–2.75)
Masters or above	17 (6.6)	22 (5.6)	39 (6)	0.916	1.05 (0.400–2.77)
Parasite	1 (0.400)	2 (0.500)	3 (0.500)	0.991	1.30 (0.117–14.39)
Number of Shifts median	8.0 (4–10)	10.0 (6–10)	10 (5–10)	0.006	1.08 (1.02–1.14)
Vitamin D <20	146 (57.0)	254 (64.3)	400 (61.4)	0.063	1.36 (0.984–1.87)
Menorrhagia	38 (11.1)	58 (18.8)	96 (14.7)	0.005	1.86 (1.20–1.80)
Dietary consumption					
Tea	299 (68.6)	138 (64.2)	437 (67.1)	0.262	0.821 (0.582–1.16)
Salad	424 (97.2)	211 (98.1)	635 (97.5)	0.489	1.49 (0.476–4.69)
Fruit	27 (7.9)	18 (5.8)	45 (6.9)	0.309	0.726 (0.392–1.35)
Vegetable	301 (87.8)	251 (45.5)	552 (84.8)	0.026	0.614 (0.399–0.947)
Meat	435 (99.8)	212 (98.6)	647 (99.4)	0.073	0.162 (0.017–1.57)
Dairy	399 (89.7)	311 (91.5)	710 (90.4)	0.393	1.24 (0.759–2.01)
Nuts	395 (90.6)	194 (90.2)	589 (90.5)	0.882	0.959 (0.551–1.67)
Coffee	161 (36.2)	145 (42.6)	306 (72.5)	0.066	1.31 (0.982–1.75)
Age				0.056	
≤40 years	44 (12.8)	22 (7.1)	66 (10.1)		
40< years <50	69 (20.1)	65 (21.1)	134 (20.6)	0.043	1.88 (1.02–3.48)
≥50 years	230 (67.1)	221 (71.8)	451 (69.3)	0.019	1.92 (1.12–3.31)
Variable	**The regression coefficient**	**S.E.**		***P***	**OR (95%CI)**
Menorrhagia	1.03	0.377		0.007	2.79 (1.33–5.83)
Number of shifts	0.079	0.030		0.008	1.08 (1.02–1.15)
Vit D <20	0.081	0.246		0.740	1.09 (0.670–1.76)
Age group					
≤40 years	-				
40–50 years	-0.615	0.377		0.068	0.541 (0.279–1.05)
>50 years	−0.620	0.518		0.232	0.538 (0.195–1.49)
Variable	**The regression coefficient**	**SD**		***P***	**OR (95%CI)**
Menorrhagia	0.610	0.228		0.008	1.84 (1.177–2.88)
Age group					
≥50 years	-				
≤40 years	0.612	0.280		0.029	1.84 (1.07–3.19)
40–50 years	0.565	0.318		0.075	1.76 (0.944–3.28)
Vegetable consumption					
Yes	-				
No	0.497	0.223		0.026	1.64 (1.06–2.54)

between the non-anemic (87.8%) and anemic (45.5%) groups. Higher vegetable consumption reduced anemia, as shown in earlier investigations.[20-22] Dietary reference consumption regulations recommend including vegetable iron sources for childbearing women.[23] Our research found that coffee users had a greater risk of anemia (42.6% vs. 36.2%) ($P = 0.066$). Coffee tannins may limit iron absorption, reducing iron bioavailability. This inhibitory activity might worsen anemia with strong physiological demands or insufficient iron intake.[24,25]

Low socioeconomic status is supposed to make people susceptible to developing anemia.[26] Wealthy classes of society are expected to maintain a better nutrition and health status than

Table 2: Comparison of anemia between female hospital staff of the studied medical center and reference group from the charity center

	Female hospital staff (%)	Reference group from charity center (%)	*P*
Anemia	215 (33)	149 (18.9)	<0.001
IDA	308 (47.3)	289 (36.6)	<0.001
Anemia/IDA	395 (60.7)	340 (43.1)	<0.001

the lower socioeconomic classes.[20,27] However, in our study, hospital staff had a higher prevalence of anemia/IDA (60.7%) compared to the charity center participants (43.1%). Martinez *et al*.[28] examined socioeconomic characteristics and wealth distribution as risk factors for anemia and found that anemia was less common among women from poorer backgrounds. Several studies have revealed a lower incidence of anemia in people with higher educational achievements[29-31]; however other studies have shown no connection.[32,33] The level of awareness about anemia was found to be higher among young working women in comparison to illiterate women residing in rural areas.[34]

Studies reported a higher frequency of anemia among women who are employed.[2,17,18,34,35] According to a recent investigation, the incidence of anemia among employed women was found to be 41.7%.[18] Research has shown that female medical students have a heightened vulnerability to the onset of anemia as a result of their demanding schedules, fluctuating eating regimens, and prolonged hours of work.[2] One study revealed that anemia was present in 40% of employed women in an African population, particularly among those with little access to formal education.[35] In the current study, 68.7% of participants had a bachelor's degree or above. Over half of the individuals had anemia, indicating that they were either not aware of their condition or did not pay attention to their health issues. Our research found that working more shifts increased the risk of anemia significantly ($P = 0.006$). Moreover, the augmentation of one unit to the work shift resulted in a substantial elevation in the chance of anemia (OR = 1.08, $P = 0.008$). It is suggested that this association may, at least in part, be due to less attention paid by these working women to their health. The study highlights the importance of addressing these factors to improve the health outcomes of working women with anemia. The promotion of knowledge about anemia, self-care considerations, dietary assortment, and supplements is essential for women of reproductive age, with a special emphasis on those who are employed. Additional studies should be carried out on a yearly basis, with a special focus on women in their reproductive years, to evaluate the frequency of anemia and the variables that contribute to its increased prevalence, including insufficient knowledge about anemia, work-related issues, and malnourishment. The inclusion of an equal number of participants who are employed and those who are not employed might potentially enhance the robustness of the comparison. Regular research will provide an opportunity to intervene and educate targeted high-risk age cohorts, thus reducing the prevalence of anemia among employed women.

Several limitations were encountered, such as the restricted scope of study and the limited exposure to the public sector. In addition, several individuals exhibited hesitancy when requested to provide a blood sample. As this research is cross-sectional, causal relationships between anemia and predictors cannot be established.

Conclusion

The current study highlighted the impact of employment on the prevalence of anemia/IDA among female hospital staff in comparison with unemployed women. The bulk of the study group was educated, yet they were uneducated about anemia risk factors and neglected their health. Consequently, the implementation of iron deficiency screening among working women of childbearing age may lead to the timely initiation of treatments aimed at avoiding anemia, such as the administration of iron supplements.

Acknowledgments

We thank all the female staff of Imam Hossein Medical Center and participants of the charity center who participated in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Miller JL. Iron deficiency anemia: A common and curable disease. Cold Spring Harb Perspect Med 2013;3:a011866. doi: 10.1101/cshperspect.a011866.
2. Vibhute NA, Shah U, Belgaumi U, Kadashetti V, Bommanavar S, Kamate W. Prevalence and awareness of nutritional anemia among female medical students in Karad, Maharashtra, India: A cross-sectional study. J Family Med Prim Care. 2019;8:2369-72.
3. Collaborators GA. 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 Haematol 2023;10:E713-34.
4. World Health Organization GHODRWHS. Prevalence of Anemia among Women of Reproductive age (% of Women Ages 15-49)-Iran, Islamic Rep. World Bank Group; 2019.
5. Kassebaum NJ. The Global burden of anemia. Hematol Oncol Clin North Am 2016;30:247-308.
6. World Health Organization %J World Health Organization. Geneva S. Nutritional anaemias: Report of a WHO scientific group [meeting held in Geneva from 13 to 17 March 1967] [WHO website]. 1968. Accessed April 3, 2023. 2023.
7. Saydam BK, Genc RE, Sarac F, Turfan EC. Prevalence of anemia and related factors among women in Turkey. Pak J Med Sci 2017;33:433-8.
8. World Health Organization %J World Health Organization. Geneva S. WHO Global Anaemia estimates, 2021 Edition Global anaemia estimates in women of reproductive age, by pregnancy status, and in children aged 6-59 months. 2021.
9. Alvarez-Uria G, Naik PK, Midde M, Yalla PS, Pakam RJA. Prevalence and severity of anaemia stratified by age and gender in rural India. Anemia 2014;2014:176182. doi: 10.1155/2014/176182.
10. Soppi ET. Iron deficiency without anemia–A clinical challenge. Clin Case Rep 2018;6:1082-6.
11. Scholz BD, Gross R, Schultink W, Sastroamidjojo S. Anaemia is associated with reduced productivity of women workers even in less-physically-strenuous tasks. Br J Nutr 1997;77:47-57.

12. Deal JA, Carlson MC, Xue QL, Fried LP, Chaves PH. Anemia and 9-year domain-specific cognitive decline in community-dwelling older women: The women's health and aging study II. J Am Geriatr Soc 2009;57:1604-11.
13. Perez EM, Hendricks MK, Beard JL, Murray-Kolb LE, Berg A, Tomlinson M, *et al*. Mother-infant interactions and infant development are altered by maternal iron deficiency anemia. J Nutr 2005;135:850-5.
14. Kassebaum NJ, Jasrasaria R, Naghavi M, Wulf SK, Johns N, Lozano R, *et al*. A systematic analysis of global anemia burden from 1990 to 2010. Blood 2014;123:615-24.
15. Tijerina-Sáenz A, Martínez-Garza NE, Ramírez-López E, Solís-Pérez E, Martínez-Báez AZ. Iron status and dietary intakes of iron in normal-weight and obese young Mexican women. Nutr Hosp 2015;31:2412-8.
16. Bathla S, Arora S. Prevalence and approaches to manage iron deficiency anemia (IDA). Crit Rev Food Sci Nutr 2022;62:8815-28.
17. Wolmarans P, Dhansay MA, Mansvelt EP, Laubscher JA, Benadé AJ. Iron status of South African women working in a fruit-packing factory. Public Health Nutr 2003;6:439-45.
18. Shah SA, Soomro U, Ali O, Tariq Y, Waleed MS, Guntipalli P, Younus N. The prevalence of anemia in working women. Cureus 2023;15:e44104. doi: 10.7759/cureus. 44104.
19. Bruinvels G, Burden R, Brown N, Richards T, Pedlar C. The prevalence and impact of heavy menstrual bleeding (menorrhagia) in elite and non-elite athletes. PloS One 2016;11:e0149881. doi: 10.1371/journal. pone. 0149881.
20. Mishra AS, Lakhera PC, Pandey A. Assessment of nutritional anemia on the basis of dietary pattern estimation among the population of Garhwal Himalayan region. J Family Med Prim Care 2021;10:669-74.
21. Egbi G, Gbogbo S, Mensah GE, Glover-Amengor M, Steiner-Asiedu M. Effect of green leafy vegetables powder on anaemia and vitamin-A status of Ghanaian school children. BMC Nutr 2018;4:1-10. doi: 10.1186/ s40795-018-0235-x.
22. Stuetz W, Gowele V, Kinabo J, Bundala N, Mbwana H, Rybak C, *et al*. Consumption of dark green leafy vegetables predicts vitamin A and iron intake and status among female small-scale farmers in Tanzania. Nutrients 2019;11:1025. doi: 10.3390/nu11051025.
23. Institute of Medicine Panel on M. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington (DC): National Academies Press (US). Copyright 2001 by the National Academy of Sciences. All rights reserved.; 2001.
24. Munoz L, Lönnerdal B, Keen CL, Dewey KG. Coffee consumption as a factor in iron deficiency anemia among pregnant women and their infants in Costa Rica. Am J Clin Nutr 1988;48:645-51.
25. Kumera G, Haile K, Abebe N, Marie T, Eshete T. Anemia and its association with coffee consumption and hookworm infection among pregnant women attending antenatal care at Debre Markos Referral Hospital, Northwest Ethiopia. PloS One 2018;13:e0206880. doi: 10.1371/journal.pone. 0206880.
26. Ismail IM, Kahkashan A, Antony A, Vk S. Role of socio-demographic and cultural factors on anemia in a tribal population of North Kerala, India. Int J Community Med Public Health 2017;3:1183-8.
27. Balarajan YS, Fawzi WW, Subramanian SV. Changing patterns of social inequalities in anaemia among women in India: Cross-sectional study using nationally representative data. BMJ Open 2013;3:e002233. doi: 10.1136/bmjopen-2012-002233.
28. Flores-Martinez A, Zanello G, Shankar B, Poole N. Reducing anemia prevalence in Afghanistan: Socioeconomic correlates and the particular role of agricultural assets. 2016;11:e0156878. doi: 10.1371/journal. pone. 0156878.
29. Tesfaye TS, Tessema F, Jarso H. Prevalence of anemia and associated factors among "apparently healthy" urban and rural residents in Ethiopia: A comparative cross-sectional study. J Blood Med 2020;11:89-96.
30. AlFaris N, ALTamimi J, AlKehayez N, AlMushawah F, AlNaeem A, AlAmri N, *et al*. Prevalence of anemia and associated risk factors among non-pregnant women in Riyadh, Saudi Arabia: A cross-sectional study. Int J Gen Med 2021;14:765-77.
31. Baig-Ansari N, Badruddin SH, Karmaliani R, Harris H, Jehan I, Pasha O, *et al*. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. Food Nutr Bull 2008;29:132-9.
32. Sadeghian M, Fatourechi A, Lesanpezeshki M, Ahmadnezhad E. Prevalence of anemia and correlated factors in the reproductive age women in rural areas of tabas. J Family Reprod Health 2013;7:139-44.
33. Asghari S, Mohammadzadegan-Tabrizi R, Rafraf M, Sarbakhsh P, Babaie J. Prevalence and predictors of iron-deficiency anemia: Women's health perspective at reproductive age in the suburb of dried Urmia Lake, Northwest of Iran. J Educ Health Promot 2020;9:332.
34. Kanal K, Busch-Hallen J, Cavalli-Sforza T, Crape B, Smitasiri S. Weekly iron-folic acid supplements to prevent anemia among Cambodian women in three settings: Process and outcomes of social marketing and community mobilization. Nutr Rev 2005;63:S126-33.
35. Ayoya MA, Bendech MA, Zagré NM, Tchibindat F. Maternal anaemia in west and central Africa: Time for urgent action. Public Health Nutr 2012;15:916-27.