Anemia in pregnant Sudanese women. *Community based study*

Ishaq Adam, *MD.*
Gehad El-Ghazali, *MD, PhD.*
Munier Mohamedin, *MSc,*
Mustafa I. Elbashir, *MD, PhD.*

Anemia adversely affects pregnancy and its outcome.[1,2] Many risk factors for anemia have been identified in pregnancy.[3] Although, it is known that around 40% of the women presenting to the labor room in Central Sudan are probably anemic,[4] there are no published data regarding anemia, its epidemiology and the risk factors during pregnancy in Sudan.

We performed a community-based study to estimate the incidence, timing and the risk factors for anemia during pregnancy in a population of Sudanese women in the Eastern Sudan. Pregnant women in Alhara Aloula and Al-Thaniya (New Halfa sugar factory) were approached to participate in the study in August 2003. After a verbal consent, a fixed questionnaire containing sociodemographic characters, obstetrical history, as well as the known risk factors of anemia was filled, including history of abortion, lack of antenatal care (ANC), iron supplementation, use of oral contraceptive pills (OCP), bed net use, history of malaria, history of schistosomiasis, and pica. All patients were examined clinically, to detect signs of anemia if present and the mid upper arm circumference (MUAC) was measured. Spleen was palpated and the gestational age was confirmed by ultrasound in cases of discrepancy. Hemoglobin (Hb) was estimated by colorimeter (WPA, United Kingdom) and blood films for malaria were prepared using Giemsa stain. A well trained technician who was blinded to the women's data carried out the laboratory investigations. Data was entered in a microcomputer using SPSS for windows. The students t-test, compared the mean ± standard deviation (SD) of the age, gestational age, MUAC and Hb. The odds ratio were calculated for the risk factors. a $p \leq 0.05$ and odds ratio >1 were considered significant.

One hundred and nineteen pregnant women at the mean ± SD gestational age of 26.2 ± 7.6 weeks were enrolled in the study. Thirty-one (26.1%) were anemic (Hb < 9.5 g/dl) and 1/31 (3.2%) was severely anemic (Hb=5.6 g/dl); of these anemic women, 1/31 (3.2%) was in her first trimester, 10/31 (32.3%) in the second trimester and 20/31 (64.5%) were in the third trimester.

The mean age, parity, gestational age and MUAC were not significantly different between the anemic and non-anemic women. Primigravidae, lack of ANC, lack of tonics, not using OCP or bed nets,

Table 1 - Risk factors for anemia during pregnancy in anemic versus non-anemic subjects.

Characteristics	Anemic (N=31) n (%)	Non-anemic (N=88) n (%)	OR	95% CI
Primigravidae				
Yes	8 (25.8)	22 (25)	1.04	0.42 - 2.6
No	23 (74.2)	66 (75)		
Abortion				
Yes	6 (19.4)	21 (23.9)	0.76	0.27 - 2.1
No	25 (80.6)	67 (67.1)		
Not using OCP				
Yes	31(100)	7 (8)	1.38	1.2 - 1.5
No	0 (0)	81 (92)		
Lack of ANC				
Yes	17 (54.8)	41 (46.6)	1.3	0.61 - 3.1
No	14 (45.2)	47 (53.4)		
Not using tonics				
Yes	18 (58.1)	43 (48.9)	1.4	0.63 - 3.3
No	13 (41.9)	45 (51.1)		
Pica				
Yes	14 (45.2)	21 (23.9)	2.6	1.1 - 6.28
No	17 (54.8)	67 (76.1)		
History of Malaria				
Yes	16 (51.6)	50 (56.8)	0.81	0.35 - 1.8
No	15 (48.4)	38 (43.2)		
Not using bed nets				
Yes	20 (64.5)	40 (45.5)	2.1	0.93 - 0.5
No	11 (35.5)	48 (54.5)		
History of schistosomiasis				
Yes	3 (9.7)	5 (5.7)	1.7	0.39 - 7.9
No	28 (90.3)	83 (94.3)		
Spleen				
Yes	3 (9.7)	5 (5.7)	1.7	0.39 - 7.9
No	28 (90.3)	83 (94.3)		
Twins				
Yes	2 (6.5)	1 (1.1)	6	0.52 - 68.6
No	29 (93.5)	87 (98.9)		

OCP - oral contraceptive pill, ANC - antenatal care, OR - odds ratio, CI - confidence interval

pica, history of schistosomiasis, twins and spleenomegaly were associated with anemia. History of abortion and history of malaria were not associated with anemia in this study (**Table 1**).

Acknowledgment. We wish to thank the Health Authority in Khassala State, all the women who participated in the study, and the administration and all the staff of New Halfa Sugar Factory and special thanks are offered to Ms. Tagwa and Mr. Abdalla Ahmed for their excellent technical work.

Received 20th September 2003. Accepted for publication in final form 16th March 2004.

From the Department of Obstetrics and Gynecology (Adam), New Halfa Teaching Hospital, New Halfa and the Department of Biochemistry (El-Ghazali, Mohamedin, Elbashir), Faculty of Medicine, University of Khartoum, Sudan. Address correspondence and reprint requests to: Dr. Ishaq Adam, Department of Obstetrics and Gynecology, New Halfa Teaching Hospital, PO Box 61, New Halfa, Sudan. Tel. +249 (421) 22101/21880. Fax. +249 (421) 22070. E-mail: ishagadam@hotmail.com

References

1. Aimakhu CO, Olayemi O. Maternal haematocrit and pregnancy outcome in Nigerian women. ***West Afr J Med*** 2003; 22: 18-21.
2. Brabin BJ, Hakim M, Pelletier D. An analysis of anemia and pregnancy-related maternal mortality. ***J Nutr*** 2001; 131: 604-615.
3. Suega K, Dharmayuda TG, Sutarga IM, Bakta IM. Iron-deficiency anemia in pregnant women in Bahli, Indonesia: a profile risk factors and epidemiology. ***Southeast Asian J Trop Med Public health*** 2002; 33: 604-607.
4. Ahmed SM, Abd Al-Rahim SK, Mohmadani AA, Habour AB, Sadek AA. Malaria parasitemia during delivery. ***Saudi Med J*** 2001; 23: 684-688.

Changing survival statistics among extreme premature infants in Oman

Shabih Manzar, *MD, FAAP.*
Arun K. Nair, *MD, FRCPCH.*
Mangalore G. Pai, *MD.*
Saleh M. Al-Khusaiby, *FRCPCH, PhD.*

A previous report has shown a survival rate of 44% among 26 week preterm infants in Oman.[1] The study included infants born during the period of November 1991 to February 1998. A follow up study during the period of March 1998 to December 1999 from the same institution, has shown further improvement in the survival rates.[2] The better outcome was attributed to the better care and use of liberal policies regarding early intervention in these extreme premature infants. This is a report on the survival pattern among the premature 26 week gestational age infants during January 2000 to November 2003, from another major institution in Oman.

Table 1 - Summary of survival statistics among 26 week preterm infants in Oman.

Study period	Total admissions	Total survived	Survival rate %
November 1991 to February 1998 (76 months)[1]	25 (0.32/month)	11	44
March 1998 to December 1999 (22 months)[2]	10 (0.45/month)	8	80
January 2000 to November 2003 (35 months)*	29 (0.82/month)	22	76

* present study

The audit was carried out at the neonatal intensive care unit (NICU) of the Royal Hospital in Muscat, one of the main tertiary centers of the country. The records of all preterm infants with gestational age of 26 weeks, were extracted from the computerized database and reviewed for the outcome. Survival was defined as alive at discharge from the NICU.[3]

Gestational assessment of the infants was based on maternal history, counting days from the last menstrual period, antenatal ultrasound and postnatal Dubowitz's score. A total of 29 premature 26 week infants were admitted during the study for a period of 35 months, (January 2000 to November 2003) giving a figure of 0.82 admissions per month. This reflected an increasing number of admissions in the recent years, as compared to the previously reported figures of 0.32/month and 0.45/month.[1,2] The survival rate in the present cohort was noted to be 76%, 22 survived out of 29 infants (**Table 1**).

We noted a continued improvement in the survival pattern among extreme premature Omani infants, which is comparable to reported statistics from Australia, the United States of America and the United Kingdom.[3-7] The improving survival statistic is reflective of the better care provided to these infants. We hope that this trend will further improve, and we will be able to achieve an even better statistics than the western world.

Received 29th December 2003. Accepted for publication in final form 7th March 2004.

From the Department of Child Health (Neonatal Intensive Care Unit), Royal Hospital, Muscat, Sultanate of Oman. Address correspondence and reprint requests to: Dr. Shabih Manzar, Department of Child Health (Neonatal Intensive Care Unit), Royal Hospital, PO Box 1331, Postal Code 111, Muscat, Sultanate of Oman. Fax. +968 599410. E-mail: shabihman@hotmail.com

References

1. Manzar S. Survival pattern among extreme preterm infants. ***Saudi Med J*** 2000; 21: 168-170.
2. Nair PMC. Survival of extreme preterm infants in an intensive care set up. ***Saudi Med J*** 2000; 21: 891-892.
3. Effer SB, Moutquin JM, Farine D, Saigal S, Nimrod C, Kelly E et al. Neonatal survival rates in 860 singleton live births at 24 and 25 weeks gestational age. A Canadian multicenter study. ***BJOG*** 2002; 109: 740-745.
4. Ferrara TB, Hoekstra RE, Couser RJ, Gaziano EP, Calvin SE, Payne NR et al. Survival and follow up of infants born at 23 to 26 weeks gestational age: effects of surfactant therapy. ***J Pediatr*** 1994; 124: 119-124.
5. Hagan R, Benninger H, Chiffings D, Evans S, French N. Very preterm birth: a regional study. Part 2: The very preterm infants. ***BJOG*** 1996; 103: 239-245.
6. Rennie JM. Perinatal management at the lower margin of viability. ***Arch Dis Child Fetal Neonatal Ed*** 1994; 74: 214-218.
7. Bohin S, Draper ES, Field DJ. The impact of extremely immature infants on neonatal services. ***Arch Dis Child Fetal Neonatal Ed*** 1994; 74: 110-113.

Does physician's awareness of peripheral arterial disease affect its prevalence and outcome

Abdullah M. Al-Wahbi, *MD.*
Khaled H. Al-Jaber, *MD.*
Ali I. Al-Haqawi, *MD.*
Fahad M. Al-Mujarri, *MD.*

Atherosclerosis is a common disease, which affects all arterial beds in the body. Myocardial infarction and cerebral vascular accidents are the most common causes of death recognized all over the world. Peripheral arterial disease (PAD) encompasses those entities that result in arterial occlusions in vessels other than those of the coronary and intracranial vascular beds.[1] The prevalence of PAD is, however, less recognized than myocardial infarction and stroke. Studies have shown that it is common, affecting 8-12 million individuals in the United States of America (USA) and is associated with significant mortality and morbidity.[2] In the Arab world, there is a misconception that PAD is uncommon and it commonly affects the western population. This misconception leads to the unawareness of presentation of the disease, delayed diagnosis and management with the high prevalence of amputation, affecting the quality of life and even leading to death.

In this survey, we wanted to evaluate the effect of the awareness of PAD among the front line physicians, family medicine (FM) and emergency room (ER) physicians on its prevalence and outcome. A questionnaire on the knowledge and the practical management of PAD was distributed to 100 FM and ER physicians working at King Abdul-Aziz Medical City in Riyadh, Kingdom of Saudi Arabia. It contained 25 single and multiple answer questions, and included one item for suggestions. Nine questions on personal information and clinical experience involved years of experience, place of work such as ER or primary care clinic, number of patients per week, and average consultation time. Sixteen questions involved definition, prevalence, risk factors and signs and symptoms of PAD, definition and treatment of intermittent claudication, definition, technique and interpretation of ankle brachial index (ABI), management of patients with absent leg pulses with or without ulcers and evaluation of vascular system in patients with diagnosis of PAD. The final 3 questions were suggestions to improve the awareness and hence, the outcome of PAD. Out of the 100 questionnaires distributed, 63 responded (55 FM physicians and 8 ER physicians). Mean age was 40 years, 39 (63%) were male, 71% have post graduate qualification, 34 (54%) > 10 years experience, 7 (11%) had some vascular surgery experience, 53 (84%) take 5-10 minutes for consultation, 44% believed that PAD is either uncommon or rare, 42% see > 200 patients per week and the majority, 56 (89%) knew the definition of intermittent claudication. Although, 97% theoretically will refer leg pain and absent pedal pulses to the vascular clinic, only 52% will carry out vascular exam on patients with risk factors of PAD. The majority knew the risk factors and signs and symptoms of PAD, 33% did not know the definition of ABI, and 59% did not know where it is carried out. Only 30% will carry out ABI for patients with PAD, 59% will manage PAD by controlling risk factors, 36% did not know how to treat PAD and 72% thought that PAD is under diagnosed. The majority suggested courses, workshops, and lectures to increase the awareness of PAD.

With the aging population around the world, the prevalence of PAD is increasing.[3] It is common in both men and women and increases in prevalence with age, such that at least 12% of adults aged 65 or older will have significant disease diagnosed by non-invasive tests without classic intermittent claudication.[3] Although much research has concentrated on the coronary and cerebral forms of atherosclerosis disease, PAD has received little attention from epidemiologists. Management was also affected by this conception, although atherosclerosis risk factors are prevalent in PAD patients, those patients receive less intensive treatment of hyperlipidemia and hypertension than patients with coronary artery disease. Subjects with symptoms of PAD appear to have the same increased risk of cardiovascular events and death

found in claudicants. Not only is PAD common in the west, Professor Al Zaharanni in 1997, by looking at the prevalence of PAD in a defined population of elderly high-risk Saudi patients, found that in contrast to the general impression that PAD is an uncommon disease, he found a significant prevalence rate of PAD in elderly high risk patients.[4] The non-recognition of PAD among family physicians is documented in many studies in the USA and Europe.[5] The majority of FM and ER physicians are aware and believe that myocardial infarction and stroke are common and have a high index of suspicion to diagnose and have good knowledge to treatment. Unfortunately, this is not true for PAD, with an average knowledge of the disease and a false belief that it is uncommon, the majority do not carry out a vascular assessment and do not identify PAD as one of the diagnoses. Lack of awareness is a patient factor too. In our part of the world, due to lack of education, people believe that leg pain with walking is a normal process of aging, therefore, there is no need to complain or visit a physician. This lack of awareness from patients and front line physicians will lead to the delay in PAD presentation to the specialist, where limb saving measures are too late and amputation is the only treatment to save the life of the patient. The under diagnosis of PAD will lead to late intervention to prevent the occurrence of the associated myocardial infarction and stroke, with its high mortality and morbidity and long term poor quality of life.

Received 23rd November 2003. Accepted for publication in final form 14th March 2004.

From the Vascular Surgery Division, Department of Surgery (Al-Wahbi) and the Department of Family Medicine (Al-Jaber, Al-Haqawi, Al-Mujarri), King Fahad National Guard Hospital, Riyadh, Kingdom of Saudi Arabia. Address correspondence and reprint requests to: Dr. Abdullah M. Al-Wahbi, Consultant Vascular Surgeon, King Fahad National Guard Hospital, PO Box 22490, Riyadh 11426, MC-1446, Kingdom of Saudi Arabia. Tel. +966 (1) 2520088 Ext. 4119. Fax. +966 (1) 2520051. E-mail: alwahbi1@hotmail.com, wahbia@ngha.med.sa

References

1. Ouriel K. Detection of Peripheral Arterial Disease in Primary Care. ***JAMA*** 2001; 286: 1380-1381.
2. Hirsch AT, Criqui MH, Treat-Jacobson D, Regensteiner JG, Creager MA, Olin JW et al. Peripheral Arterial Disease detection, Awareness and Treatment in Primary Care. ***JAMA*** 2001; 1317-1324.
3. Newman AB. Peripheral Arterial Disease: insight from population studies of older adults. ***J Am Geriatr Soc*** 2000; 48: 1157-1162.
4. Al-Zahrani HA, Al-Bar HM, Bahnassi A, Abdulaal AA. The distribution of Peripheral Arterial Disease in a defined population of elderly high-risk Saudi patients. ***Int Angiol*** 1997; 16: 123-128.
5. Futterman LG, Lemberg L. Peripheral Arterial Disease is only the tip of the "ice berg". ***Am J Crit Care*** 2002; 11: 390-394.

Postoperative wound infection in surgical procedures

Ahmed M. Al-Hashemy, *FACHARTZ,*
Mohamed I. Seleem, *FRCS, MD,*
Zaka-Allah A. Khan, *FRCS, PhD,*
Seif M. Nowry, *MBBS, FRCS.*

A wound is defined as a break in an epithelial surface which may be surgical or accidental. Burns, ulceration and pressure sores have been excluded in this definition, but drain sites should be included.[1] Infection is the most common form of postoperative morbidity and a major cause of mortality in all surgical specialties. Wound infection is a well recognized complication of the surgical treatment and sometimes places a high burden on hospital resources. However, advances in theatre design and practice, surgical techniques, antibiotic prophylaxis and wound care have served to reduce the reported incidence in a recent series in different surgical specialties. Consequently, a detailed evaluation was carried out to establish the true incidence of wound infection in different specialties in the surgical procedures, to identify any shortcomings in current practice, recommend ways of eliminating these and finally to re-audit and quantify any improvement.

A retrospective review of all positive wound cultures from the Microbiology Department were taken for a period of 6 months, from December 1996 to May 1997. The 3 major specialties of the surgical directorate general surgery, urology and orthopedics were included in the study. Only 12 true postoperative wound infections were detected. Operative records show the total number of operations performed in the same period was 1331, of these, 866 were open procedures. Revised and implemented guidelines were designed to reduce the incidence of infection; 1. Documentation. It is strongly recommended that both doctors and nurses document very clearly in the patient's notes and properly fill out the microbiology form for future reference. 2. Theatre layout. a) Temperature and air control should be regulated properly; b) it is recommended that any new staff joining the theater, be first introduced to the head nurse, who will then undertake the responsibility for the training, and c) minimize the movement, avoid moving in and out of the theatre during surgery. 3. Instruments must be covered until positioned on the table. 4. Wards. a) Hibiscrub hand wash should be available in every patient room for the nurses and the surgeon; b) shaving should be carried out on operative table prior to surgery; and c) patient for laparoscopic

surgery should have a Betadine soaked swab in his/her umbilicus, the night before surgery 5. Infection control. Antibiograms should be distributed to all clinicians every 3 to 4 months.

A subsequent audit between November 1999 to April 2000 was made to evaluate the new policy. The initial audit showed only 12 postoperative wound infections. There were 9 (1.79%) in general surgery, one (0.78%) in urology and 2 (0.84%) in orthopedics. The operating time in the 3 specialties ranged from 15-150 minutes. There were 5 cases in category I (clean operation), 4 cases in category II (potentially infected operation), 2 in category III (infected operation), and one in category IV (dirty operation) (**Table 1)**. The microbiology indicated 5 cases with *Escherichia Coli*, 3 cases with *Staphylococcus aureus*, 2 cases with *Enterococcus faecalis* and one case each of *Providencia* and *Citrobacter* infection. The treatment regime for the above infections were also identified. Three patients were treated with simple dressings, 4 patients needed antibiotics and dressings, one patient required incision and drainage of the collection, one had a laparotomy and irrigation, 2 patients required debridement and surgical toilet and in one patient the treatment was unspecified. Re-audit following strict implementation of the new guidelines, showed the incidence of wound infection to be 6 patients (0.64%) in general surgery, 0% in urology and one patient (0.16%) in orthopedics.

In order to minimize postoperative surgical wound infection, it is important to create and maintain a safe working environment and monitor patient risk factors. There are 4 factors which may affect the organisms, causing surgical wound infection, 1. prophylaxis antibiotics, 2. prolonged preoperative hospital stay, 3. trauma, and 4. outbreaks of nosocomial surgical wound infection. However, in our surgical practice, antibiotics prophylaxis is used routinely according to the wound categories and the international recommendation. The postoperative wound infections were classified according to the National Research Council into 4 categories, clean, potentially infected, infected and dirty.[2] Greenall et al,[3] reported the incidence of the wound infection in these categories at 1%, 8%, 19% and 46% respectively. A similar study in the Kingdom of Saudi Arabia recorded an overall rate of infection at 9% and the rate of wound infection in the 4 categories were 9.5%, 6%, 21% and 71%.[4] In our study, the overall rate of infection was 1.38% and the rate of wound infection in the 4 categories were 0.83%, 2%, 3.3% and 16.6%, while in the re-audit, the overall infection rate was 0.36% and the rate of wound infection in the 4 categories were 0.07%, 1%, 0% and 6.6%. Our study showed a low rate of postoperative wound infection in comparison to international figures and the re-evaluation proved that even lower infection rates can be attained.

Table 1 - The incidence of wound infection in relation to operation category before and after introduction of revised guidelines.

Operation category	Audit			Re-audit		
	n of operations	wound infection n	(%)	n of operations	wound infection n	(%)
I	600	5	(0.83)	1371	1	(0.07)
II	200	4	(2)	400	4	(1)
III	60	2	(3.3)	100	0	(0)
IV	6	1	(16.6)	30	2	(6.6)
Total	**866**	**12**	**(1.38)**	**1901**	**7**	**(0.36)**

Acknowledgment. We would like to thank Olivia M. Robinson, infection control specialist nurse for assisting data collection.

Received 4th October 2003. Accepted for publication in final form 15th March 2004.

From the Departments of Surgery (Al-Hashemy, Seleem), Orthopedics (Khan) and Urology (Nowry), Armed Forces Hospital, Southern Region, Khamis Mushayt, Kingdom of Saudi Arabia. Address correspondence and reprint requests to: Dr. Ahmed M. Al-Hashemy, Department of Surgery, Armed Forces Hospital, Southern Region, PO Box 101, Khamis Mushayt, Kingdom of Saudi Arabia. Tel/Fax. +966 (7) 2500001 ext. 2508. E-mail: aelhashemy@yahoo.com

References

1. Peel ALG, Taylor EW. Proposed definitions for the audit of postoperative infection: a discussion paper. ***Ann R Coll Surg Engl*** 1991; 73: 385-388.
2. National academy of science National Research Council adhoc Committee of the Committee on trauma, division of Medical Sciences, postoperative wound infection. The influence of ultraviolet irradiation of the operating room and of various other factors. ***Ann Surg*** 1964; 160 Suppl 2: 1-192.
3. Greenall MJ, Atkinson JE, Evans M, Pollock AV. Single-dose antibiotic prophylaxis of surgical wound sepsis: which route of administration is best?. ***J Antimicrob Chemother*** 1981; 7: 223-227.
4. Makhtar AM, El-Tahwy AT, Khalaf RM, Bahnassy AA. Postoperative wound infection: aetiology, Predisposing factors and recommendation for control. ***Saudi Med J*** 1993; 14: 32-36.

Daily iron supplementation versus intermittent dose

Anila Jaleel, *MBBS, PhD.*
Mohamad A. UrRahman, *PhD, DSc.*

Iron deficiency anemia is a major nutritional and public health problem in the developing countries. In South East Asia the prevalence among these population groups is estimated to be between 50-70%. It affects large fraction of important physiological groups such as children, menstruating and pregnant women.[1,2] Iron deficiency anemia is treated traditionally by iron supplementation given daily. Many debates have been reported on intermittent therapy of iron versus daily supplementation. It was hypothesized that the administration of oral iron impairs the absorption of subsequent iron dose and would lead to reduced absorption several days after initiation; whereas, with intermittent supplementation the level of absorption would remain much higher. Mucosal block theory proposes that mucosal ferritin functions more as a repository for iron that is not rapidly transferred to the circulation, thus it prevents rapid absorption rather than true block in iro absorption. Inhibitory effect of prior iron is due to reduction in postabsorptive rise in iron concentration due to previously fed iron. Daily iron supplementation induces severe diarrhea possibly due to direct irritation of gastric or duodenal mucosa, alteration in gastric or intestinal motility or rapid entry of iron to portal or systemic circulation. The frequency of these symptoms correlates with the concentration of ionized iron in the intestinal lumen and the amount of absorbed iron, as addition of ascorbic acid, which is a strong enhancer of iron absorption, aggravates symptom.[3] Therefore, the compliance of iron is influenced by side effects,

Table 1 - Comparison of hemoglobin (Hb), iron, total iron binding capacity and ferritin in reproductive women, postmenopausal women and male subjects before and after supplementation. The values are expressed as mean and standard error of mean.

Supplementation	**Female subjects**						**Male subjects**		
	Reproductive group age=15-45			**Postmenopausal stage age=46-65**			**age=25-55**		
	Daily n=10	**Weekly single dose n=10**	**Weekly double dose n=10**	**Daily n=10**	**Weekly single dose n=10**	**Weekly double dose n=10**	**Daily n=10**	**Weekly single dose n=10**	**Weekly double dose n=10**
Pre-suppl.									
Hb (g%)	10.10±0.61	10.40±0.10	10.20±0.16	9.80±0.16	10±0.16	10±0.10	10±0.16	9.80±0.19	10.20±0.40
Serum iron (µmol/l)	4.90±0.22	7.40±1.51	6.90±0.51	6.30±0.32	7.40±0.32	7.30±0.38	9±0.73	7.50±0.38	7.80±1.50
TIBC (µmol/l)	97±0.45	94±1.40	94.80±1.34	93±1.78	79±10.30	87.20±1.18	84.60±1.18	83.80±0.96	84.40±4.50
Serum ferritin (ng/ml)	17±2.07	16.30±1.02	15.50±1.46	23.60±1.5	22±1.46	24±1.05	25.60±1.31	9.80±6	24.60±3.3
Post- suppl.									
Hb (g%)	11.80*±0.13	10.60±0.70	11.50*±0.19	11.60*±0.25	10±0.13	12.60*±0.16	13*±0.22	10.40*±0.22	12.30*±0.90
Serum iron (µmol/l)	10.70*±0.67	7.90±0.54	14.40* ±1.05	17*±0.92	7.90±0.35	13.50*±0.38	16.95*±0.98	8.10±0.41	15*±2.70
Serum TIBC (µmol/l)	57±5.92	93±1.15	60.10*±2.20	59.70±1.02	77±3.15	37.40*±0.96	51.33*±3.51	81.50±0.76	54.40*±3.40
Serum ferritin (ng/ml)	69*±4.49	18±0.99	26*±2.45	108.30*±10.38	24±1.53	102.40*±4.99	104.70*±6.39	33.90±1.91	58.10*±1.37

*significant compared with pre-supplementation data (p<0.001), TIBC - total iron binding capacity, Pre-suppl. - pre-supplementations, Post-suppl. - post-supplementation.

which are dose related. If the supplements of iron are taken once or twice weekly, the patient will experience less symptoms as well as they will invest less money on supplementation, which can result in improving the compliance of the patients to iron intake. Moreover, adverse interactive effect of large amounts of iron on absorption of other micronutrients would be reduced. Large dose of iron produces oxy free radicals that can cause deleterious effects resulting in serious chronic disease.[3]

This study included 90 apparently healthy individuals. These subjects were selected from nearby communities. They were divided into 3 groups of 30 subjects each. First group comprised of male subjects of age between 25-45 years, second group was of postmenopausal women of age between 46-65 years and third group of reproductive age group that is between 15-45 years. Those individuals suffering from chronic illness, diarrhea, pregnant and lactating mothers were excluded from the study. Each group was further divided into 3 subgroups of 10 male subjects, 10 postmenopausal and 10 women of reproductive age groups. The first subgroup was given iron supplements (ferrous sulfate 300 mg) daily. The second subgroup received supplementation (ferrous sulfate 300 mg) on weekly basis that is 6 times for 36 days and third subgroup received iron supplements in double dose (ferrous sulfate 600 mg) on weekly basis that is 6 times for 36 days. Procedure was explained to the subjects and they signed informed consent. Blood samples were collected by aseptic technique in 2 separate tubes for hematological determination and serum estimations. Blood samples from each subject were analysed for hemoglobin, mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH) on sysmex pre-supplemental and post-supplemental. Serum iron and total iron-binding capacity (TIBC) was carried out on Clinicon 4010 and serum ferritin on enzyme-linked immunosorbent assay (ELISA) both pre-supplementally and post-supplementally. The results obtained were calculated statistically by estimating mean and standard error of mean was (SEM). Paired t-test was then applied and *p*-value obtained. Hemoglobin (Hb), serum iron, serum ferritin, MCV and MCH were less than their normal range pre-supplementally indicating iron deficiency. Hemoglobin, serum iron and serum ferritin levels increased significantly and TIBC levels decreased significantly in groups receiving iron supplements daily and double dose weekly (**Table 1**). mean corpuscular volume and MCH also increased in daily and double dose weekly groups in reproductive, male and postmenopausal women. As in reproductive age group, MCV increased to 84.4 and 85.6 μm^3 (pre-supplemental values are 77.30 and 76.40) and MCH to 26.2 and 27.4 pg/dl (pre-supplemental values are 25.30 and 24.70) in daily and double dose weekly. In this study it was found that Hb, MCV, MCH, serum iron and serum ferritin increase significantly and serum TIBC decreases significantly in reproductive group of women, males and postmenopausal women when given iron supplements on daily and double dose weekly (**Table 1**). There was no significant rise in all these parameters in subjects receiving iron therapy as single dose (ferrous sulfate 300 mg) as shown in (**Table 1**). This is in accordance to study by Shobha and Sharda,[4] which verifies that an iron supplement given twice weekly resulted in iron status comparable with that after daily supplement. In another study by Gilgen and Mascie-Taylor,[5] anemic Bangladeshi women responded well to daily as well as weekly supplementation. Similar studies are carried out in China and Indonesia as well, which proves that with twice weekly dosing, the level of absorption decreases rapidly after a few days.

It is concluded, that iron supplementation given on weekly basis such as double dose (ferrous sulfate 600mg) as compared to 300 mg ferrous sulfate, gave similar results as that of subjects receiving supplementation (ferrous sulfate 300 mg) on daily basis. Ferritin stores on the subjects receiving daily supplementation were more as compared to those receiving double doses weekly. Weekly supplementation prevented excessive accumulation of iron in the tissues and is as beneficial as daily supplementation and also reduces side effects such as diarrhea or constipation due to intake of iron. Weekly double dose supplementation can be used as a preventive strategy to control iron deficiency anemia especially in reproductive age group of women, who have to undergo stress of pregnancy and delivery.

Received 24th November 2003. Accepted for publication in final form 21st March 2004.

From the Department of Biochemistry, Ziauddin Medical University, Karachi, Pakistan. Address correspondence and reprint requests to: Dr. Anila Jaleel, Ziauddin Medical University, ST 4, Block 6, Shahrah-e-Ghalib, Clifton, Karachi, Pakistan. E-mail: aneelajaleel@hotmail.com

References

1. Hercberg S, Preziosi P, Galen P. Iron deficiency in Europe. ***Public Health Nutr*** 2001; 4: 537-545.
2. Mungen E. Iron supplementation in pregnancy. ***J Perinat Med*** 2003; 31: 420-426.
3. Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. ***Am J Clin Nutr*** 2000; 71: 1288-1294.
4. Shoba S, Sharada D. Efficacy of twice weekly iron supplementation in anemic adolescent girls. ***Indian Pediatr*** 2003; 40: 1186-1190.
5. Gilgen D, Mascie-Taylor CG. The effect of weekly iron supplementation on anemia and on iron deficiency among female tea pluckers in Bangladesh. ***J Human Nutr Diet*** 2001; 14: 185-190.