Daily versus weekly iron supplementation: Programmatic and economic implications for Indonesia

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Abstract

Available information on iron deficiency and anaemia among Indonesian population groups was analysed to identify the at-risk groups in Indonesia and to suggest more efficient intervention programmes to reduce its high prevalence. The results showed that the groups with the highest prevalence of anaemia were pregnant women (52.3%), working adult women (27.9%), pre-schoolers (27.1%), adolescent girls (21.1%), the elderly (10.9%), and primary-school children (6.8%). Pre-school children and adolescents need iron supplementation to provide enough iron for growth and cognitive functioning during childhood. Adolescent girls need iron supplementation to develop sufficient iron reserves before pregnancy and to improve working performance. Pregnant and lactating women also need iron supplementation. Strategies to control anaemia include improvement in dietary habits, food fortification, and supplementation. Unless feeding behaviour is changed or food fortification is adapted nationwide, oral iron supplementation

remains the mainstay of the prevention and treatment of anaemia. Weekly supplementation has been shown to be an effective and economic method of supplementation. With the current approach of daily supplementation recommended by the World Health Organization, Indonesia would have to spend US$360 million annually, but weekly dosing would require only US$15 million to cover the same target population. Weekly dosing offers a practical and economic means of improving iron status in developing countries.

Introduction

Anaemia is recognized as a major nutritional problem affecting a majority of the women and children in developing countries. The World Health Organization (WHO) estimates that more than two billion people are affected by iron deficiency or anaemia. Most are in the Western Pacific and South-East Asia, but they can be found in all countries [1]. Despite its increasing prevalence in South-East Asia [2], anaemia is the most neglected nutritional deficiency disorder in the region today [3]. The most affected groups, in approximate descending order, are pregnant women, preschool-age children, low-birthweight infants, other women of child-bearing age, the elderly, school-age children, and adult men [1, 4].

Iron-deficiency anaemia has severe nutritional and health consequences, including inadequate growth and mental development in children, high maternal mortality, high incidence of low-birthweight infants, and low productivity in adults [1]. Poor school performance among schoolchildren and adolescents has been associated with iron-deficiency anaemia [5-7]. Low physical performance was also observed in a group of adolescents in London [8].

In Indonesia, although some pilot studies on supplementation trials among pre-school children have been conducted [9], routine oral iron supplementation has been focused only on pregnant women [10]. Despite a national programme for the last 20 years, the prevalence of anaemia decreased only slowly from 70% in 1983 to between 55% and 60% in 1992 [11]. The main reasons for the ineffectiveness of the programme are low compliance and inefficient delivery systems [12, 13]. Another factor may be the late administration of supplements. Pregnancy is the period of greatest demand for iron [14], but improving iron nutrition during this period is difficult. The conventional target approach of providing iron plus folate during the second trimester does not adequately address the problem. Careful evaluation of

the critical period when supplementation should take place is required to minimize scarce budgetary resources.

FIG. 1. Prevalence of anaemia in different population groups in Indonesia. Abbreviations: Adoles, adolescents; PS, pre-schoolers; SC, schoolchildren

The present overview, based on the current experience gained in Indonesia, describes population groups that are at high risk of anaemia and analyses the effect of weekly dosing of iron so that future intervention programmes can be initiated for not only curative but also preventive purposes.

Prevalence of anaemia in different population groups

Subjects were randomly chosen in each population group from a series of cross-sectional surveys conducted in selected rural and urban areas in Jakarta and Yogjakarta, Indonesia. The methods and results have been reported [12, 13, 15-18]. Anaemia is defined here as haemoglobin levels <120 g/L among adolescent girls and elderly women, <110 g/L among pre-school children and pregnant women, and <130 g/L among adult and elderly men [19].

Figure 1 summarizes the prevalence of anaemia in different Indonesian population groups. The average prevalence was highest among pregnant women (52.3%). In both rural and urban areas, the prevalence of anaemia in pregnant women was not associated with age (p >.05), but it was associated with months of pregnancy (p <.001; X^2 test) and whether they lived in a rural or an urban area. As shown in figure 2, anaemia in rural areas appeared at a low rate in the third month of pregnancy (18%) and was highest in the fifth month of pregnancy (75%). It decreased to 33% at nine months. In urban areas, anaemia occurred as early as the second month of pregnancy (50%) and reached a prevalence of 100% in the eighth month. Pregnant women in this study belonged to the low- and middle-income groups; urban pregnant women were more severely anaemic than rural ones (fig. 2). Suharno et al. [20] found a similar prevalence of anaemia (49.4%) in pregnant women in West Java. The most commonly identified reason for this high prevalence was the low availability of iron in the rice-based Indonesian diet [21-23].

The prevalence of anaemia in non-pregnant women was 27.9%, and no men were found to be anaemic. The prevalence of anaemia among adult women in this study was lower than that among non-pregnant Chinese cotton mill workers (34%) [24] but remained within the range of the prevalence of anaemia in Indonesia nine years ago [11]. Iron supplements resulted in

improved productivity [9] and production efficiency [25]. Among the elderly, the prevalence was higher in women (13.1%) than in men (8.9%).

FIG. 2. Prevalence of anaemia in pregnant women in urban and rural areas in Indonesia

FIG. 3. Prevalence of anaemia in urban pre-schoolers in Indonesia

The prevalence of anaemia among pre-school-age children was 26.4% for boys and 27.9% for girls, with a combined prevalence of 27.1%. The prevalence of anaemia in pre-schoolers was not associated with sex ($p > .05$; X^2 test). The highest prevalence of anaemia (32% to 36%) was at 17 to 35 months of age in both boys and girls (fig. 3). The high prevalence of anaemia (34.9%) in this study as early as 17 to 23 months reflects depleted iron stores [26]. An even higher prevalence is found before 17 months [27, 28]. During this period, the iron requirement is so high that breastmilk alone cannot meet the requirement of iron for rapid growth [29]. Breastmilk contains 0.5 mg iron per litre during the first month post-partum, falling to about 0.3 mg/L at 4 to 6 months. Assuming a mean daily intake of 673 ml milk 1 month after birth and 896 ml at 6 months [30], the calculated daily iron intake falls from 0.34 mg at 1 month to 0.27 mg at 6 months. Other factors, such as repeated attacks of infectious diseases and the low content and bioavailability of iron in the diet, put the young child at higher risk for anaemia. The prevalence of anaemia decreased to 12.9% at 48 to 60 months (fig. 3). A lower prevalence in this age group was also reported among Chinese [27] and Chilean [28] pre-school children. This age-dependent dynamic of anaemia is consistent with the epidemiology of nutritional anaemia [31]. The prevalence was 9.1% among school-age boys but only 4.5% among school-age girls, with a combined prevalence of 6.8%.

The prevalence was 21.1% in adolescent girls but only 2.5% in adolescent boys. The high prevalence of anaemia among adolescent girls may be due to menstrual losses, which average 38.0% ± 1.2% of the total iron losses, and the occurrence of the second growth spurt [32] combined with low dietary iron intake [33].

Current iron supplementation programmes in Indonesia

The current programmes to control anaemia in Indonesia include daily iron supplementation of pregnant women through the integrated health posts and community health centres, nutrition education, and food fortification [10]. The low indication of improvement, as shown in this study, simply reflects the limited

effectiveness and sustainability of these programmes. To encourage dietary modification, emphasis must be placed also on the diversity of food produced and on improved access to these foods. Changing people's behaviour requires long and intensive national and community-based actions, such as mass media campaigns and other formal and informal education in the community, that support each other synergistically. Food fortification, the medium-term strategy, offers benefits faster than dietary modification. However, many operational problems may be encountered [1, 34].

The present high prevalence of anaemia in most age groups justifies a broad intervention programme [35]. In developing countries, where dietary iron is unlikely to be sufficient to overcome an iron deficit, iron supplements are often relied upon as a cure for anaemia. This curative strategy of giving iron supplements when the anaemia already exists is frequently of limited effectiveness and sustainability because of poor compliance due to the negative side-effects of daily dosing [13].

Weekly dosing in iron supplementation

The Indonesian experience showed that the prevalence of iron-deficiency anaemia is highest in preschool children and pregnant women. These two peaks of prevalence have different causes: the high growth spurt in infants, and menarche in women leading to depleted iron storage from blood loss. The need for iron is aggravated during pregnancy. A curative approach alone is not sufficiently effective to reduce markedly the high prevalence of anaemia in pregnancy. Preventive iron supplementation of women before pregnancy is required to prevent iron-deficiency anaemia during pregnancy. Dietary changes and food fortification are important long-term strategies but cannot be expected to have a rapid impact.

Several studies in different population groups have shown that weekly dosing successfully reduces anaemia and is as effective as daily administration in preschool children [15], adolescent girls [36], and non-pregnant [37, 38] and pregnant [18] women.

Costs of iron supplementation

WHO/UNICEF recommend that universal iron-folate supplementation should be implemented for all pregnant and lactating women, for infants and children six months through five years of age, and for pre-adolescent girls and women from 10 to 49 years of age, in populations where the prevalence of anaemia is over 30% [39]. In this recommendation, no specific information

is provided about when and for how long supplements should be administered. However, an earlier recommendation [40] stated that in areas with high prevalence, pregnant women should receive 60 mg elemental iron and 250 µg folate twice a day for 180 days, and normal infants should receive 1 mg elemental iron per kilogram body weight per day from six months to five years of age. Supplementation from the age of two months is recommended for low-birthweight infants. For adolescent girls, 60 mg elemental iron twice a day for two to three months is recommended. Table 1 shows the recommended duration of iron supplementation for each intervention group. On the basis of a calculation of the price of supplementation for the different intervention groups, a yearly budget of US$360 million would be needed to follow the 1992 WHO recommendation in Indonesia. Although the economic return would be higher because of increased productivity and learning ability and fewer infections, it would be unrealistic to expect an investment of this size for reducing iron-deficiency anaemia alone.

TABLE 1. Duration of iron supplementation of different target populations in Indonesia with the current WHO-recommended daily dosing approach versus the suggested new weekly dosing approach

Target population	Current WHO approach [a]	Suggested new approach [b]
Pregnant women	180 d	26 wk
Lactating women	120 d	17 wk
Infants (0.5-1 yr)	180 d	26 wk
Low-birthweight infants	300 d	40 wk
Pre-schoolers (>1 <5 yr)	60 d/yr	16 wk [c]
Adolescent girls (10 -<19 yr)	60 d/yr	9 wk/yr

a. Two tablets/day for pregnant and lactating women and adolescent girls (one tablet = 60 mg elemental iron and 250 µg folate); 30 mg elemental iron per day for infants.

b. Two tablets/week for pregnant and lactating women; one tablet/week for adolescent girls (one tablet = 60 mg elemental iron and 250 µg folate); 30 mg elemental iron per week for infants.

c. Two eight-week periods in four years.

TABLE 2. Estimated annual cost of iron supplementation of different target populations in Indonesia with the current WHO-recommended daily dosing approach versus the suggested new weekly dosing approach

Target population	Millions of people (% of total) [a]	Cost in millions of US dollars	
		Current WHO approach	Suggested new approach
Pregnant and lactating women	5.5 (2.9)	3.9	0.5 [b]
Infants (0.5-1 yr)	1.9 (1.0)	11.4	1.6 [c]
Low-birthweight infants	0.5 (0.3) [d]	5.4	0.7 [c]
Pre-schoolers (>1 <5 yr)	19.7 (10.3)	315.2	10.5 [c]
Adolescent girls (10 - <19 yr)	29.9 (11.6)	23.6	1.6 [b]
Total	57.5 (25.8) [e]	359.5	14.9

a. Based on estimated 1996 population of Indonesia (total, 191 million) Source: Directorate of Nutrition, Department of Health, Indonesia.

b. US$1 per 1,000 iron pills [41].

c. US$1 per bottle (150 ml) of iron syrup containing 6 mg elemental Fe per millilitre (local manufacturer's price).

d. 15% of infants have low birthweight [42].

e. Does not include low-birthweight infants.

On the basis of the experience gained in Indonesia, a different approach is suggested for iron supplementation, which is shown in table 2. This approach differs from the WHO approach mainly in two aspects:

First, on the basis of the promising results in Indonesia, *weekly* doses are suggested for all age groups. This will reduce costs to one-seventh of the daily administration.

> Second, it has been shown in pre-school children that iron supplementation for eight weeks has an effect lasting for many months, until the age when iron requirements decline and can be met by common food sources [43].

When these two differences are taken into account, the yearly budget for iron supplementation in Indonesia would be US$15 million, only 4.2% of the cost of the strategy recommended by WHO.

Weekly supplementation not only is more efficient but also is far less demanding of organizational and administrative efforts, because the reduced number of tablets and syrup bottles allows an increase in the coverage of the programme. In Indonesia traditional birth attendants have access to pregnant and lactating mothers and low-birthweight infants. Schoolteachers have contact with schoolchildren and adolescent girls, and factories employ many non-pregnant women. All of these could be enlisted in support of weekly supplementation. Weekly iron supplementation is cheaper and also offers opportunities for wider coverage.

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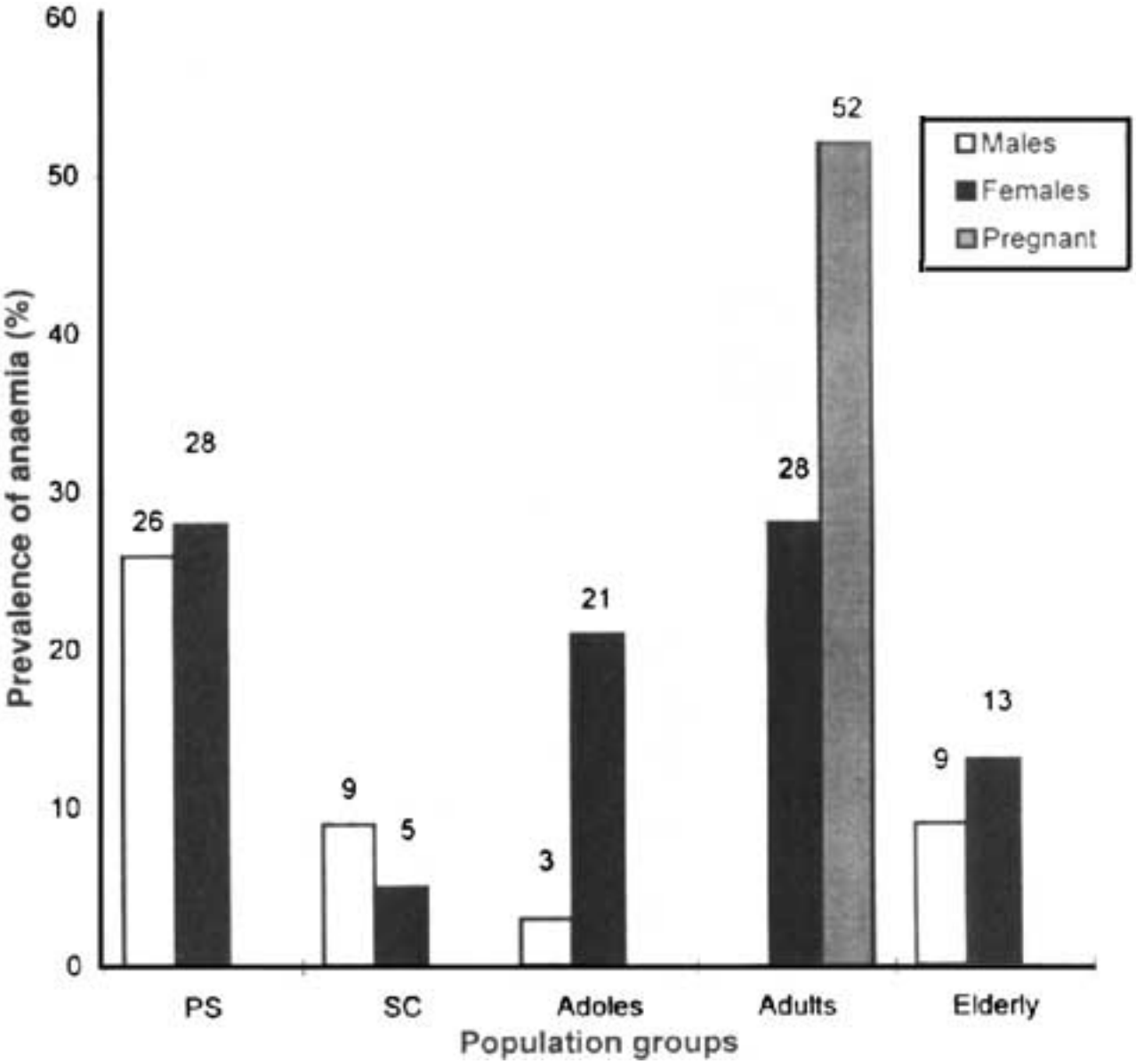
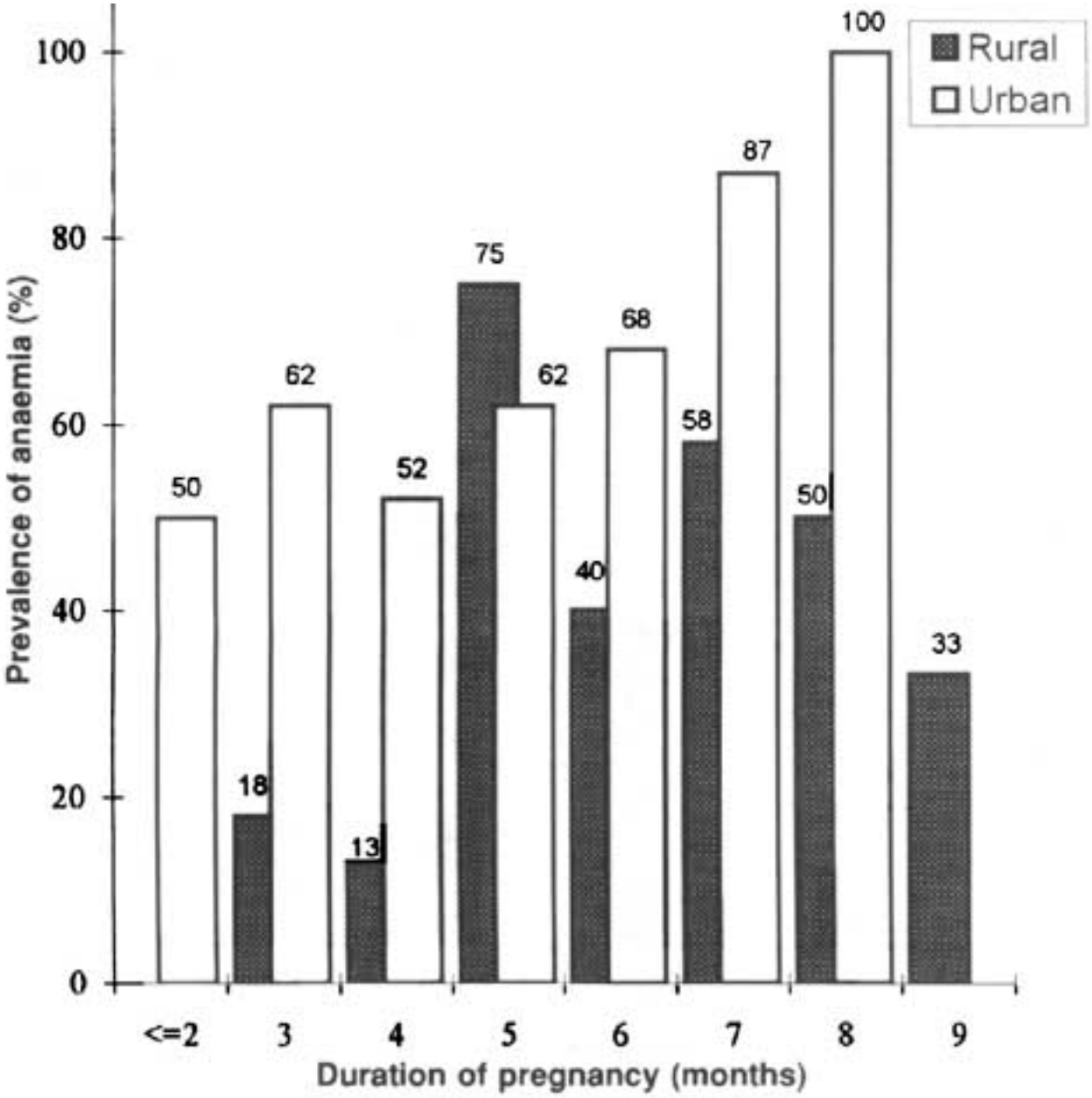

60
50
40
30
20
10
0
Prevalence of anaemia (%)
Males
Females
Pregnant
26
28
9
5
3
21
28
52
9
13
PS
SC
Adoles
Adults
Elderly
Population groups


Rural
Urban
Prevalence of anaemia (%)
100
80
60
40
20
0
50
18
62
13
52
75
62
40
68
58
87
50
100
33
<=2
3
4
5
6
7
8
9
Duration of pregnancy (months)