A study of prevalence of anaemia in adolescent girls and reproductive-age women in Kuala Lumpur

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Abstract

Introduction: Anaemia is a common disorder of the haemopoietic system commonly found in the developing countries. The present study was undertaken to highlight the prevalence of anaemia in healthy adolescent girls and a reproductive-age group of adult women residing in an urban area.
Material and methods: A total of 441 individuals comprising healthy, non-pregnant, non-lactating, reproductive-age women (aged 13 to 50 years) participated in the study. Informed consent was taken and the individuals were screened for haemoglobin level. Anthropometric measurements including body weight and height were recorded. All statistical data were analyzed using the program Statistical Package for Social Sciences.
Results: Mean body weight of adolescent girls (52.5 ±11.0 kg) was significantly lower ($p < 0.05$) than adult women (57.7 ±13.4 kg). Based on the body mass index (BMI) classification of the World Health Organization, the majority of adolescents (77.4%) and adults (50.7%) were classified as normal. Only a small proportion of adolescents (2.2%) and adults (16.1%) were classified as underweight. Mean value for haemoglobin of adolescents (12.6 ±0.9 g/dl) was significantly higher ($p < 0.001$) than adults (12.1 ±1.3 g/dl). Prevalence of anaemia amongst adults (41.7%) was higher than adolescents (28.3%). Nutrient intake of anaemic adolescents was lower than non-anaemic adolescents.
Conclusions: The results highlight the prevalence of anaemia in adolescent girls and reproductive-age women which may be helpful in combating this common disorder in the urban population.

Key words: anaemia, reproductive-age, adolescent, health.

Introduction

Anaemia is defined as a low level of haemoglobin in the blood and it is one of the world's most widespread nutritional problems [1]. Anaemia symbolizes both poor nutrition and poor health. In the world, more than 2 billion people suffer from anaemia. It has an impact on psychological and physical development, behaviour, and work performance [2]. It is a severe health problem in nearly all developing countries, where between one-third and one-half of the female and child populations are anaemic [1].

The risk of developing anaemia in developing countries is greater than in any developed countries. Women and children are the most vulnerable

individuals. Anaemia prevalence is usually higher in rural areas than urban areas. Several studies on prevalence of anaemia have been carried out in rural areas of Malaysia, including those in adult women [3], Malay men and women [4], pregnant women [5, 6] and young adult women [3, 7, 8]. The results of these studies showed that the prevalence of anaemia was high (17 to 47%). However, there was only one study which reported data from the urban areas of Malaysia [9].

Keeping the above facts in mind, the aim of the present study was to determine the prevalence of anaemia in adolescent girls and reproductive-aged women in an urban area of Kuala Lumpur.

Material and methods

A cross-sectional study was conducted in Kuala Lumpur, Malaysia in mid-2006. Subjects comprised healthy and non-pregnant reproductive-aged adult women between 20 and 50 years old, and adolescent girls aged between 13 and 17 years were selected because of the simple reason that the secondary school had girls in the above-mentioned age group. The inclusion criteria for adult women were non-pregnant as declared by subjects themselves, pre-menopausal, and healthy women aged between 20 and 50 years. The inclusion criteria for the adolescent girls was that they were healthy and literate. Adolescent girls were randomly selected from four secondary schools in Kuala Lumpur, Malaysia, while adult women were recruited from police living quarters, churches and dental clinics at Universiti Malaya and Universiti Kebangsaan Malaysia (UKM). Prior to commencement of the study, ethical approval was obtained from the UKM Medical Research and Ethics Committee (FF-189-2006). Permission from the Ministry of Education and the relevant heads of organizations was also obtained. Subjects were briefed about the study and the adults signed a written informed consent form while the adolescent girls obtained parental informed consent before they participated in the study.

Haemoglobin status, blood collection and analyses

Portable haemoglobinometers (Hemocue AB, Angelholm, Sweden), because of their portability, ease of use and faster result yielding property, were used to assess blood haemoglobin concentration of the subjects. During data collection, calibration was made using the specially prepared sample provided by the manufacturer to confirm the stabilization of the reading of blood haemoglobin before measurement.

A sample of capillary blood was collected from the middle finger using a microlance. The first drop of blood was wiped off to stimulate blood flow; only then was the blood drawn into a microcuvette by capillary action. A new microcuvette has to be used to re-take the blood if air is found in the microcuvette during blood collection. After that, the microcuvette was put in the haemoglobinometer and the reading observed after 10 to 20 min. In this study, anaemia was defined according to the World Health Organization definition which considers the haemoglobin (Hb) level to be less than 12.0 g/dl for both adolescent girls and non-pregnant women [10].

Anthropometric measurements

Body weight and height measurement were recorded without shoes and in light clothing. Weight was measured to the nearest 0.5 kg using a Tanita digital weighing scale Model HD 309 (Tanita, Japan). Height was measured using SECA Bodymeter 208 (SECA, Germany) to the nearest 0.1 cm. Body mass index (BMI) was calculated as weight (kg)/height $(m)^2$. Body mass index status was categorised according to the WHO classification for adults [11] and WHO BMI-for-age classification for adolescents [12].

Dietary intake

Dietary intake of subjects was obtained by 24-h dietary recall. Subjects were interviewed to obtain information on food intake throughout the previous day. Information on meal time, types and quantity of food and cooking methods were collected. During the interview, food models and household utensils were used to help subjects estimate food quantity as accurately as possible. The nutrient intakes for subjects were analyzed using Diet 4, computer software based on the Malaysia Food Composition Table [13]. Energy and nutrient intakes were compared with the Malaysian Recommended Nutrient Intake (RNI) [14], which was established for specific sex and age groups.

Questionnaire

A questionnaire was designed to obtain personal details of the subjects. There were two different set of questionnaires specific for adolescents and adults, respectively. The questionnaire of adolescent girls included information on socio-demographic and socioeconomic characteristics, such as parental education levels and parental occupation, position among siblings and the number of siblings. For adult women, the questionnaire included basic demographic details, education levels and spouse income. Both sets of questionnaires included consumption of dietary supplements, menstrual status, health status and the family history of certain diseases such as anaemia, thalassaemia and high blood pressure. The subjects were also asked questions related to vegetarian or non-vegetarian practices.

The questions for menstrual status consisted of age of menarche, usual flow of menses self-defined as light, moderate or heavy, average number of days of menstruation cycle, and average number of days of bleeding during menstruation. The questionnaires were answered by the subjects themselves and help was provided only if they could not understand the questions. For illiterate subjects the questionnaire was asked in the form of an interview.

Data analysis

All the data was analyzed using the program Statistical Package for Social Sciences (SPSS) for Windows version 12.0. Normality test by Kolmogorov-Smirnov was done to check the distribution before data analysis. Descriptive statistics which included mean, standard deviation and the percentage of data were calculated. Spearman correlation and Pearson correlation were used to determine the relationship between haemoglobin status with energy and nutrient intakes. Student's *t*-test was performed to determine significant differences between nutrient intakes of anaemic and non-anaemic adolescent girls and adult women, and between physical characteristics of adolescent girls and adult women.

Results

Socioeconomic characteristics

A total of 230 adolescent girls and 211 adult women participated in this study. The socio-demographic characteristics of the subjects are shown in Table I. The mean age of adolescent girls was 15.1 ±1.1 years, while the mean age of adult women was 31.9 ±9.2 years.

Mean monthly household income for adolescent girls and adult women were similar, at RM2386 ± 2075 and RM2364 ±4643, respectively (Malaysian Ringgit, 100 RM = 19.49 Euro). Both groups also had a similar trend with the majority of monthly incomes being less than RM1500, and then followed by a range between RM1500 to RM3500, with a higher range above RM3500, with no significance found between the two groups. There were more adult women (34.1%) than adolescent girls (31.7%) whose monthly household income ranged between RM1500 and RM3500.

Physical characteristics of subjects

Mean body weight of the adolescent girls was significantly lower ($p < 0.01$) than adult women, whereas mean height for adolescents and adults were not significantly different (Table II). Based on the BMI classification of the World Health Organization, the majority of the subjects were in the normal weight category, with only a small proportion classified as underweight and a slightly larger proportion categorised as overweight.

The mean value for haemoglobin of adolescents (12.6 ±0.9 g/dl) was significantly higher ($p < 0.001$) than adults (12.1 ±1.3 g/dl). Prevalence of anaemia amongst adults (41.7%) was higher than adolescents (28.3%).

Nutrient intake

Nutrient intakes of anaemic and non-anaemic adult women and adolescent girls are presented in Table III.

The percentage of adult women and adolescent girls with nutrient intake below RNI is shown in Figure 1. Intakes of iron and calcium of anaemic adolescent girls were the most critical; 100% of anaemic adolescent girls failed to meet the RNI requirement. Energy, vitamin B_1, iron and calcium intakes were the most unattainable nutrients for adult women and adolescent girls despite their anaemic status, with more than 90% failing to meet RNI requirements. On the other hand, vitamin A and vitamin B_3 were the most easily achieved nutrients

Table I. Socio-demographic characteristics of subjects

	Adolescent girls (n = 230) no. (%)		Adult women (n = 211) no. (%)
Ethnic			
Malays	136 (59.1)		122 (57.8)
Chinese	47 (20.4)		59 (28.0)
Indians	40 (17.4)		17 (8.1)
Others	7 (3.1)		13 (6.2)
Education level	**Father**	**Mother**	
No formal education	6 (2.6)	11 (4.8)	0
Primary	20 (8.7)	28 (12.2)	5 (2.4)
Secondary	138 (60)	143 (62.2)	92 (43.6)
Tertiary	66 (28.7)	48 (20.9)	114 (54.0)
Monthly household income			
< RM 1500	112 (48.7)		99 (46.9)
RM 1500-RM 3500	73 (31.7)		72 (34.1)
> RM 3500	45 (19.6)		40 (19.0)

Table II. Physical characteristics of subjects

	Adolescent girls (n = 230) no. (%)	Adult women (n = 211) no. (%)
Age [year]	15.1 ±1.1	31.9 ±9.2
Weight [kg]	52.5 ±11.0	57.7 ±13.4
Height [cm]	155.9 ±5.1	156.4 ±6.0
BMI [kg/m²]	21.59 ±4.26	23.6 ±5.35
Underweight	5 (2.2)	34 (16.1)
Normal	178 (77.4)	107 (50.7)
Overweight	47 (20.5)	70 (33.2)
Haemoglobin [g/dl]	12.6 ±0.9	12.1 ±1.3
< 12 g/dl	65 (28.3)	88 (41.7)
≥ 12 g/dl	165 (71.7)	123 (58.3)

by both anaemic and non-anaemic adult women and adolescent girls.

Correlation between haemoglobin level and nutrient intakes

Table IV shows the correlation between nutrient intake and haemoglobin level among adolescent girls and adult women. There was no significant correlation found between the nutrient and haemoglobin levels of adolescent girls. For adult women, a correlation was found between haemoglobin level and iron intake only, but the relationship was weak, with a correlation value of 0.152 ($p < 0.05$).

Discussion

The current study was conducted to estimate the prevalence of anaemia among adolescent girls and adult women in Kuala Lumpur, the capital of Malaysia. The majority of subjects were Malays, followed by Chinese, and Indians. The ethnic proportions of the subjects corresponded to the distribution of the ethnic population in Malaysia. All adult women were educated and their level of education was higher than that of adolescents' parents.

Amongst 230 adolescent girls and 211 adult women, the prevalence of anaemia was found to be 28.3% and 41.7%, respectively. The prevalence of anaemia among adolescent girls is considered a moderate public health problem, while amongst adult women, the prevalence of anaemia is categorised as a severe public health problem. As per WHO, if the prevalence of anaemia is equal to or greater than 40%, it can be considered a severe public health problem; otherwise prevalence in the range of 20% to 39% is to be considered as a moderate one [10].

As per an earlier study in Malaysia, the prevalence of anaemia in adolescent girls was similar to that reported among adolescent girls (28.6%) in 6 fishing villages in Sabah [8]. Nevertheless, the results of the present study showed a higher prevalence than an earlier reported study among adolescent girls aged 13-17 years in rural areas (17.4%) of Peninsular Malaysia [3].

Prevalence of anaemia amongst adult women was higher than an earlier report by Tee *et al.* (1998) confined to women residing in rural areas (25.1%)

Table III. Nutrient intake of adult women and adolescent girls

	Adult women				Adolescent girls			
	Anaemic (n = 88)		Non-anaemic (n = 123)		Anaemic (n = 46)		Non-anaemic (n = 184)	
Nutrients	Mean ± SD	%RNI	Mean ± SD	%RNI	Mean ± SD	%RNI	Mean ± SD	%RNI
Energy [kcal]	1482.3 ±416.0	71.1	1556.6 ±417.5	74.7	1375.2 ±405.3	65.4	1538.4 ±490.9	72.6
Protein [g]	60.1 ±24.0	109.2	64.3 ±25.8	117.5	54.6 ±21.6	100.6	60.6 ±23.0	109.9
Iron [mg]	11.7 ±6.6*	40.3	15.1 ±10.2*	52.0	13.5 ±6.7	42.3	15.9 ±7.9	49.3
Vitamin A [µg]	871.0 ±1523.6	174.2	964.1 ±2133.0	192.8	544.3 ±173.9	92.0	576.1 ±184.1	95.9
Vitamin B_1 [mg]	0.6 ±0.3	56.0	0.7 ±0.4	60.1	0.7 ±0.3	75.7	0.7 ±0.3	83.9
Vitamin B_2 [mg]	1.1 ±0.6	101.5	1.1 ±0.5	97.2	1.0 ±0.3	96.0	1.1 ±0.5	103.6
Vitamin B_3 [mg]	20.0 ±8.3	143.2	21.1 ±9.0	150.8	16.8 ±6.2	105.8	19.2 ±7.4	118.2
Vitamin C [mg]	57.9 ±50.7	82.7	56.1 ±54.6	80.1	34.5 ±25.7	52.7	42.9 ±32.9	64.6
Calcium [mg]	326.9 ±180.0	40.7	379.9 ±223.5	47.5	381.3 ±180.4	38.1	410.5 ±202.6	40.4

**Significant different at p < 0.05*

Table IV. Correlation between nutrient intake and haemoglobin level

	Adolescent girls		Adult women	
Nutrient	Correlation	p value	Correlation	p value
Energy	0.074	0.368	0.074	0.284
Protein	0.034	0.676	0.004	0.959
Iron	0.046	0.571	0.152*	0.027
Vitamin A	0.078	0.335	0.024	0.727
Vitamin C	0.079	0.335	0.004	0.952

**Correlation is significant at the 0.05 level*

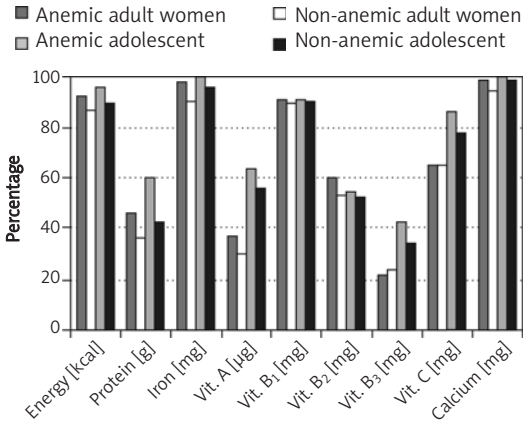

Figure 1. Percentage of subjects with intake below Malaysian RNI

[3]. This scenario was in contrast with our perception that prevalence of anaemia is usually higher in rural areas as compared to urban areas. The current study showed dissimilarity with a local study carried out in an urban area of Malaysia which stated that the prevalence of anaemia of adult women in the study was low (26%) and the iron intake was deficient, amounting to 56% [9].

The methods used to determine haemoglobin level or iron status may have contributed to the variance in results. The methodology used for the blood test was different in comparison to the previous studies which used the cyanmethemoglobin method while our study used the System Hemocue B-Hemoglobin. In the present study, we observed that the haemoglobin levels were statistically significant between adolescent girls and adult women. However, we also consider that clinical features of haemoglobin would have manifested in a different pattern. There may be different criteria for the haemoglobin levels to be clinically significant in different individuals.

When compared to Mexican women, the current prevalence of anaemia was higher. The prevalence of anaemia of non-pregnant Mexican women was 20.8% (22.6% in rural areas and 20.0% in urban areas) [15]. Nevertheless, the prevalence was similar to a study conducted in Kazakhstan among non-pregnant women living in the Kzyl-Orda region, where the prevalence of anaemia was 40.2%. The method used was almost the same as used in the current study [16].

Generally, the nutrient intake of non-anaemic was higher than anaemic for both the adolescent and adult groups. The mean intakes for most nutrients were above two thirds of RNI for all groups, while intakes of some nutrients were higher than the Malaysian RNI [14].

There was no significant difference in the nutrient intakes of anaemic and non-anaemic adult women, with the exception of iron intake (11.7 ±6.6 mg for anaemic, 15.1 ±10.2 mg non-anaemic adults, $p < 0.05$). For adult women, only vitamin C intake of the anaemic group (57.9 ±50.7 mg) exceeded that of the non-anaemic group (56.1 ±54.6 mg), although the difference was statistically insignificant. Most of the nutrients achieved two thirds or met 100% of RNI, with the exception of iron (anaemic 40.3% RNI, non-anaemic 52.0% RNI), vitamin B_1 (anaemic 56.0% RNI, non-anaemic 60.1% RNI), and calcium (anaemic 40.7% RNI, non-anaemic 47.5% RNI). However, there were some nutrients which met and exceeded RNI, including vitamin A (anaemic 174.2% RNI, non-anaemic 192.8% RNI), vitamin B_3 (anaemic 143.2% RNI, non-anaemic 150.8% RNI), protein (anaemic 109.2% RNI, non-anaemic 117.5% RNI) and vitamin B_2 (anaemic 101.5% RNI).

Amongst adolescents, intakes of all nutrients were lower in the anaemic compared to the non-anaemic group. Nutrients with mean intakes below two thirds of RNI were similar to those of adult women: iron (anaemic 42.3% RNI, non-anaemic 49.3% RNI), vitamin C (anaemic 52.7% RNI, non-anaemic 64.6% RNI), calcium (anaemic 38.1% RNI, non-anaemic 40.4% RNI) and vitamin B_1 (anaemic 75.7% RNI, non-anaemic 83.9% RNI).

Methods used to measure iron status may vary. Also, the haemoglobin status reduced significantly during the menstrual period as compared to the luteal phase [17]. The nutrient intake of anaemic individuals was lower than their counterparts for both groups. Dietary intake in both adult women and adolescent girls were deficient, with most of the nutrient intakes below the RNI of Malaysia. The low dietary intake recorded may be due to the methods used to determine dietary intake. It was easy to underestimate the intake of energy and nutrients by 24-h-recall method when applied only for one day. Additionally, socioeconomic factors may also have contributed to low intake.

The majority of the adult women were of low socioeconomic status and this influenced their ability to purchase food rich in iron (which is considered to be expensive food). Their food choice was limited since their income did not permit them to buy expensive food rich in iron. The same was also observed in adolescent girls. Most of their parents' incomes were low. The family's low purchasing power and low bioavailability of food from animal sources increased the risk of anaemia. Besides, adolescent girls' food choices were influenced by factors such as care of their body image corresponding to their age, and diet control, which was thought to adversely affect their nutrient and energy intake.

Menstruating women and adolescent girls were the groups which had critical nutritional iron deficiency [18]. The growth spurt and menstrual status affected iron stores in adolescent girls with low iron intake [19]. The accuracy of determination of diet intake among adolescents was influenced by the methods used to estimate their dietary intake. Besides, ethnicity also contributed to the methods used for estimation [20]. In this context, we opine that one should be aware that adequate dietary iron intake can help to preclude negative effects of iron losses due to menstruation during their growth spurt.

Iron requirements, bioavailability of dietary iron and amounts of iron stores are strongly related. Iron requirements are similar among iron-replete women worldwide and the main variations in iron status in different population are related to birth rates, degree of infestation with hook-worms and properties of the diets [18].

The limitations of this study were that the dietary intake was assessed for only one day

using the 24-h recall method, which means only the current dietary intake was evaluated, whereas iron status is usually affected by long-term dietary intake. Secondly, the method used to measure haemoglobin status has also been debated, but this method is simple and the machine is portable, so it was chosen for this study. Admittedly, we can identify the anaemia or haemoglobin status without knowing the factors causing it. Further studies are needed to underline the causes of the anaemia in order to prevent it and improve the anaemic status among adolescent girls and adult women in any urban setting such as Kuala Lumpur. We also admit that young adults aged 18-19 years were not included in the study.

A recent study in Malaysia found that prevalence of anaemia was higher in the teenage group, with the Indian community accounting for the majority, followed by the Malays and the Chinese [21]. The same study highlighted the importance of such findings for maternal health programme planners and implementers [21].

Dietary nutrients play an important role in the well-being of an individual. Recently it has been found that even deficiency of omega-3 fatty acids in the diet can influence the autonomic system [22]. Anaemic states are also known to influence the haemodynamic and nervous system and appropriate early prevention may help a larger section of the population.

In conclusion, our results showed that the prevalence of anaemia in adult women was higher than adolescent girls in an urban setting such as Kuala Lumpur. A weak relationship was found between the iron intake and haemoglobin levels amongst adult women. Although the prevalence of anaemia has often been used as an alternative for iron deficiency anaemia, the aetiologies of anaemia are many. There are other factors which influence the haemoglobin level besides the iron intake. Thus, the complexity of anaemia should be recognized in order to establish effective strategies to improve adolescent girls' and women's health. Understanding the prevalence of anaemia in the urban population may help to target risk groups and evaluate any interventional programmes.

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