Body Iron Stores in Thai Women of Reproductive Age

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Abstact

Body iron stores is sensitively indicated to iron status. Since iron status strongly affects to iron absorption, body iron stores is a factor of estimating the dietary iron absorption method as proposed by Monsen. This study aimed to determine body iron stores in Thai women of reproductive age, which is one of the iron deficiency risk groups. The serum ferritin levels of 115 normal iron status (serum ferritin ≥ 12 ng/ml) women aged between 18-45 years were included in the body iron stores calculation by Cook's method. The result showed that the mean body iron stores of the women was 292.78 mg. This finding was consistent with previous reports that the values were in the range of 200-400 mg in the women. The mean body iron stores were of 309 mg and nearly 300 mg in American and Australian women, respectively. The values were less than the recommended amount of 500 mg in adult women. Only 3 per cent of the Thai women in the present study met the recommended amount. So, as in American and Swedish women, less than 5 per cent of them reached the storage iron of 500 mg.

Key word : Body Iron Stores, Thai Women, Women of Reproductive Age, Ferritn

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Approximately 20 per cent of body iron is accumulated as ferritin in reticuloendothelial cells, liver, spleen and bone marrow(1). The amount of ferritin iron in those tissues is present as body iron store. The body iron store is sensitively indicated to iron status which strongly affect to iron absorption. Two dependent major factors, dietary components and body iron status were included into the mathe-

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matical model of dietary iron bioavailability calculation as proposed by Monsen[2]. The model determines the dietary iron bioavailability classified by the body iron stores categories; 0, 250, 500 and 1,000 mg. To know people's iron stores is thereby valuable for a more accurate estimation of iron bioavailability from their diets.

Women have a substantially higher prevalence of anaemia than men, because about half of their iron requirement is needed to replace iron losses in mentruation[1]. Since there is no information of Thai people's iron stores, this study was to determine the body iron stores of reproductive age Thai women with normal iron status. The data would be applied to precisely estimate dietary iron bioavilability which is valuable for readjusting the recommended dietary iron intake of women.

MATERIAL AND METHOD

Subjects

The subjects were non pregnant women aged 18-45 years, residing in the Bangkok's area. Cooperative letters were sent to 13 industrial factories around Bangkok, but only one factory agreed to cooperate. Two hundred and thirty eight women consented to be subjects. They were asked to fill up general questionnaires and have blood taken for analysis of serum ferritin by using Roche's reagent kit. The questionnaires included personal data and chronic inflammation history. There were only 118 subjects with complete questionnaires and blood analysis.

Determination of the body iron stores

The normal iron status of women as indicated by serum ferritin ≥ 12 ng/ml were included in the body iron stores study. The body iron stores was determined by Cook's method by using serum ferritin as a dependent factor in the calculation equation; body iron stores = 400 (SF - log 12), where SF was ferritin level ≥ 12 ng/ml[3]. The calculated body iron stores were presented as milligram of iron.

RESULTS

In the present study, there was 3 of 118 or 2.54 per cent of the women had serum ferritin less than 12 ng/ml. Thus, 115 women with normal serum ferritin (≥ 12 ng/ml) and no chronic inflammation history or infection during the study, were included in the body iron stores study. The women were 27.00 ± 4.98 years of age, a range of 18-44 years. 76.52 per cent of them were in the 18-29 years age group, and 23.48 per cent in the 30-45 years age group (Table 1). Approximately half of them were married. They came from every part of Thailand, but most of them were from the central part of Thailand (62.61%). The mean income of the women was 4,856.61 ± 1,782.34 baht, 2,900-15,000 baht a month. More than a half of them (63.48%) earned ≥ 4,500 baht/month.

Table 1. Characteristics of the studied women of reproductive age.

Characteristics (Total number)	Number N	Number %
Age (115)		
18-29 years	88	76.52
30-45 years	27	23.48
Marital (115)		
Single	60	52.17
Marriage	55	47.83
Origins (115)		
Central	72	62.61
North-Eastern	20	17.39
Northern	16	13.91
Southern	7	6.09
Income (107)		
< 4,500 baht/month[a]	42	36.52
> 4,500 baht/month	65	63.48

[a] The lower limit of income under Thai law is 186 baht/day, or approximately 4,500 baht/month.

Frequency distribution of the calculated body iron stores of the reproductive aged women is shown in Fig. 1. The histogram distribution was roughly symmetrical and sharp. It was skewed a little to the left. The mean value of the iron stores was 292.78 ± 120.11 mg, 30.44-600.84 mg in range. It was 295.08 mg and 165.96 mg of iron in median and mode values. The cumulative distribution of the iron stored among the women is shown in Fig. 2. The value for any percentiles can be obtained by reference to the cumulative distribution polygon. The values of the 30^{th}, 40^{th}, 50^{th}, 60^{th}, 70^{th}, 80^{th}, 90^{th} and 100^{th} percentiles were 227.88, 259.48, 295.08, 326.50, 355.29, 394.61, 437.31 and 600.84 mg of iron respectively. The body iron stores of 503.13 mg were at the 97^{th} percentile.

DISCUSSIONS

Nearly all body ferritin is intracellular, a small amount circulates in the plasma. Serum ferritin level is an early indicator of iron status. Subnormal serum ferritin values, in the range < 12 ng/ml is associated with iron deficiency[1]. Serum ferritin is

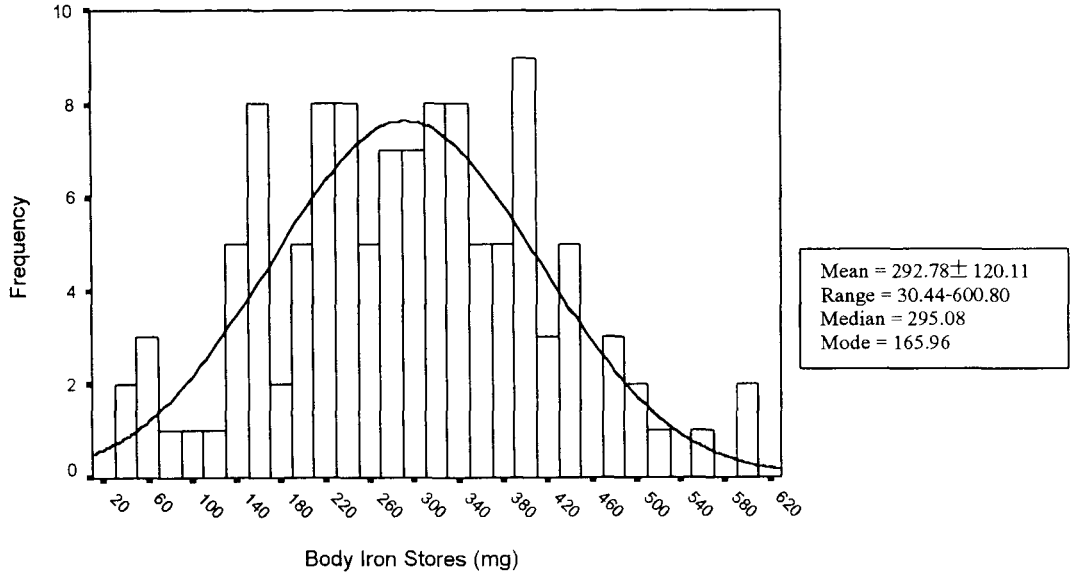

Fig. 1. Histogram of the frequency distribution and descriptive statistic values of body iron stores in the reproductive age women.

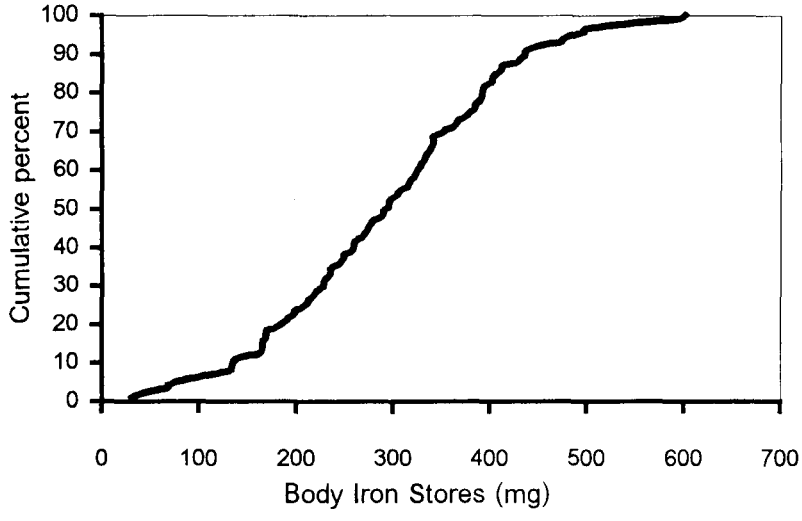

Fig. 2. Percentile distribution of iron stores in the reproductive age women.

directly related to the level of body iron. By Cook's equation of body iron stores calculation, one having serum ferritin ≤ 12 ng/ml has no iron stores. It has also been shown that a difference of 1 ng/ml in serum ferritin is equivalent to approximately 8-10 mg of storage iron in normal adults[3].

The women of reproductive age in the present study were from the medium-low economic level of the society. Their mean income was a slightly higher than the lower limit of income under Thai law, which is 186 baht/day or approximately 4,500 baht/month. The majority of the women (76.52%) were in the 18-

29 years old of age group. It was found that 2.54 per cent of them had subnormal ferritin levels of < 12 ng/ml. There were 115 normal iron status women where serum ferritin was used in the body iron stores calculation study. The results showed that the mean of their body iron stores was 292.78 mg iron. The value was also consistent with other studies of women which were in the range of 200-400 mg iron[4]. The average iron storage was 309 mg and nearly 300 mg in menstruating American women and in non pregnant Australian women, respectively[3,5,6]. It was also revealed that the average female omnivore store is about 300 mg and the average male omnivore store is 1,000 mg of iron[7]. The recommended amount of body iron stores for the low risk of iron deficiency was 500 mg in women[6]. At the 97th percentiles distribution of body iron stores, the value was approximately 500 mg in the women in the present study. As a result, only 3 per cent of the Thai women met the recommended amount of iron stores. This finding agreed with the earlier reports that less than 5 per cent of the women population in America and Sweden reached the amount of 500 mg iron stores[6]. Although the results of body iron stores in the present study and the others were the same, there was a considerable difference in the study design. Only women with normal status classified by serum ferritin were included in the present study while all women no matter what their iron status were, were studied in the other studies[3,5,6].

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ปริมาณเหล็กสะสมในร่างกายของหญิงไทยวัยเจริญพันธุ์

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ปริมาณเหล็กสะสมในร่างกายเป็นดัชนีบอกภาวะเหล็กของร่างกายที่ไว และด้วยภาวะเหล็กของร่างกายมีผลต่อการดูดซึมของเหล็กจากอาหาร ปริมาณเหล็กสะสมในร่างกายจึงใช้เป็นปัจจัยหนึ่งในการศึกษาปริมาณเหล็กที่ดูดซึมได้จากอาหาร บริโภคโดยวิธีของ Monsen การศึกษานี้มีจุดมุ่งหมายเพื่อ วิเคราะห์ปริมาณเหล็กสะสมในร่างกายของหญิงไทยวัยเจริญพันธ์ ซึ่งเป็นกลุ่มเสี่ยงต่อการขาดเหล็กกลุ่มหนึ่ง ระดับเฟอรไรตินในซีรั่มของหญิงที่มีภาวะเหล็กปกติ (ซีรัมเฟอรริติน ≥ 12 นก/มล) จำนวน 115 คน ซึ่งมีอายุ 18–45 ปี นำมาใช้ในการคำนวณปริมาณเหล็กสะสมในร่างกายโดยวิธีของ Cook ผลการศึกษาพบปริมาณเหล็กสะสมในร่างกายเฉลี่ยของหญิงที่ศึกษาเป็น 292.78 มก ผลที่ได้สอดคล้องกับรายงานการศึกษาที่ผ่านมาว่าค่าปริมาณเหล็กสะสมของหญิงอยู่ในช่วง 200–400 มก และค่าเฉลี่ยประมาณ 309 มก และ 300 มก ในหญิงอเมริกันและออสเตรเลีย หญิงไทยที่ศึกษามีเพียงร้อยละ 3 ที่มีเหล็กสะสมในร่างกายถึง 500 มก ซึ่งเป็นปริมาณแนะนำที่ลดความเสี่ยงต่อการขาดเหล็ก เช่นเดียวกับในหญิงอเมริกันและสวีเดนที่มีเหล็กสะสมถึง 500 มก เพียงร้อยละ 5

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